SCIENTIFIC AMERICAN

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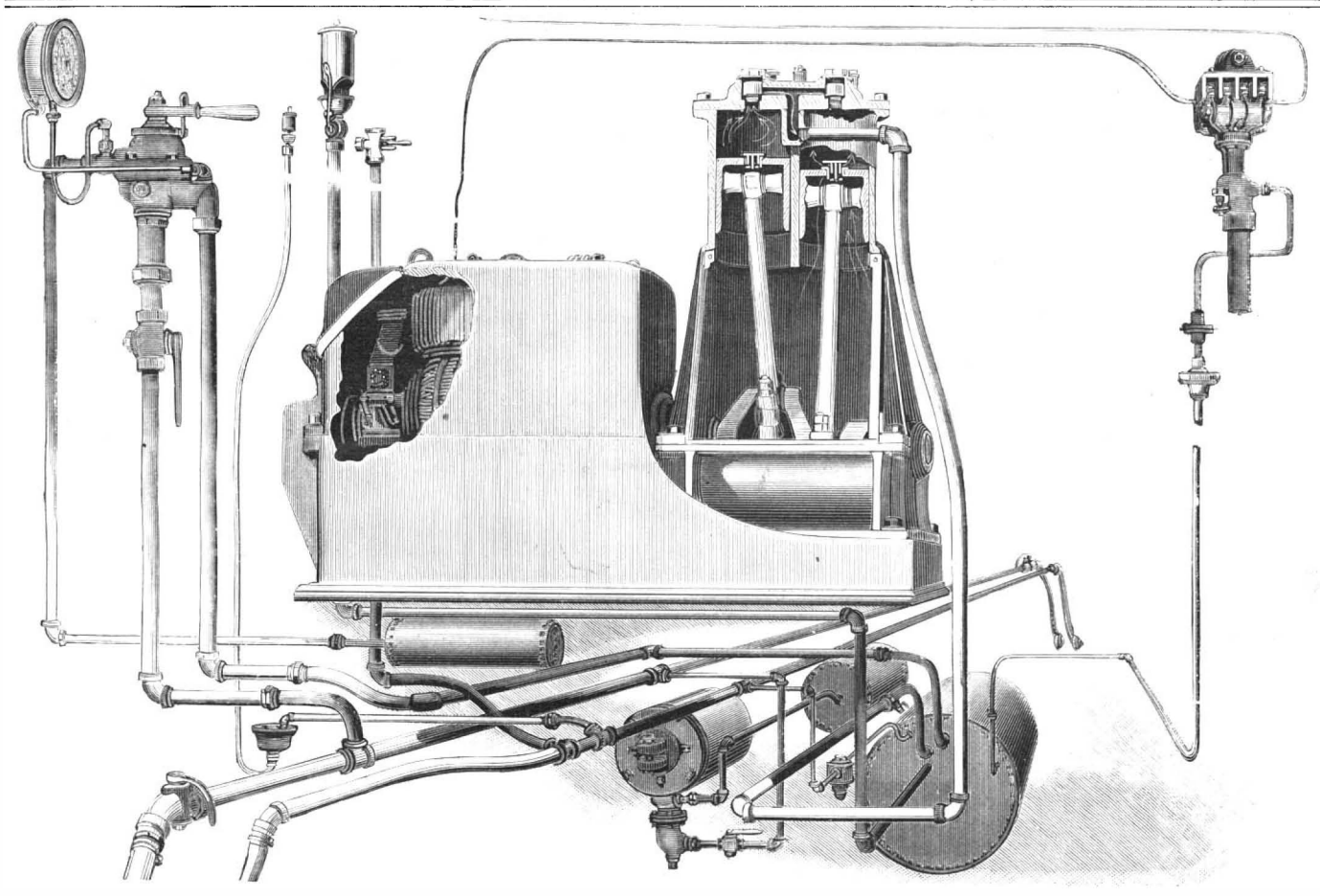
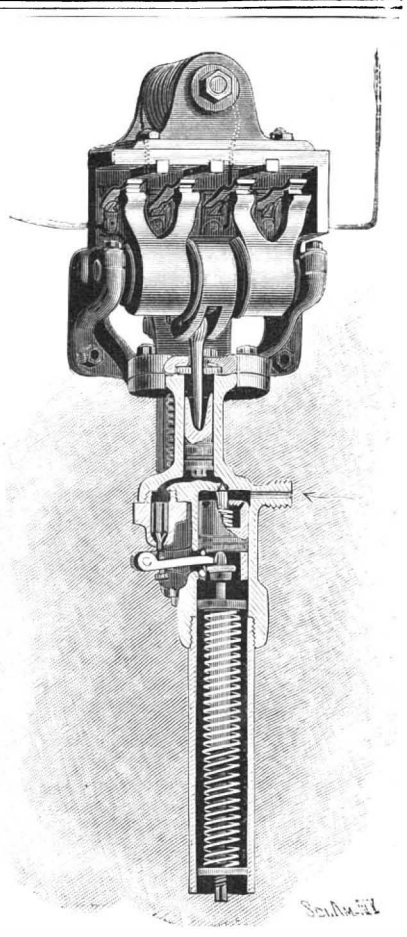


PERSPECTIVE VIEW OF AIR BRAKE EQUIPMENT.



AUTOMATIC AIR VALVE AND SWITCH.

TRAIN CONSISTING OF A MOTOR CAR AND ONE COACH RUNNING AT FULL SPEED.

THIRD RAIL ELECTRICAL EQUIPMENT OF THE NEW YORK, NEW HAVEN AND HARTFORD RAILROAD.—[See page 376.]

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LEGISLATIVE TRIFLING.

We have before us the draft of a bill recently introduced in the House of Representatives and referred to the Committee on Patents which betrays such a surprising ignorance of the true spirit and meaning of the Patent System as to make one ask how the introducer of the bill ever came to be chosen for the task, or on what grounds he felt himself to be qualified for it.

The document in question is entitled: "A bill to prohibit the granting of a patent where the thing sought to be patented is a mere rearrangement or variance in constructive devices and details of inventions already known. Second: To require the party claiming an infringement to recover judgment against the party charged with such infringement before he can maintain an action against a bona fide purchaser of the article alleged to be an infringement, and to restrict damages to the actual injury. Third: To reduce the time to sixty days in which to file an application for a patent."

It seems hardly necessary to criticise in detail a bill whose absurdities and inconsistencies are so evident to our readers.

The bill provides that no patent shall be granted for a mere rearrangement in constructive devices and details of an invention already known. Now, as every inventor in the country knows, or may readily know, such a provision is entirely superfluous for the reason that under the present practice valid patents are not "granted for a mere rearrangement in constructive devices and details" of an old invention. If the framer of the bill had perused a copy of the SCIENTIFIC AMERICAN Handbook on Patents he would have learned on page 47 that "a mere aggregation or combination of old devices is not patentable when the elements are unchanged in *function and effect;*" and knowing this he would have saved the time of the House and his own credit by omitting this altogether superfluous clause from the bill.

The second clause of the bill was probably inserted with special reference to the parties who are victimized by professional swindlers, who first sell unlawfully a patented article and then send round in the footsteps of the vender a second agent purporting to represent the inventor, who threatens to bring action for damages and compromises the matter by accepting a cash payment. Now, although we have every sympathy with the victims of this class of knavery (chiefly residents in the agricultural districts), the evil is not sufficiently widespread to call for a change in the present law, which renders both the manufacturer and purchaser liable to action. The wording of the clause is obscure, but it is evidently intended to provide that a patentee, assignee or grantee must secure judgment against an infringing manufacturer of his patent before he can proceed against the user of it. Apart, however, from the bearing it might have upon the swindling operations above referred to, this provision is entirely unnecessary, for in case the unlicensed manufacturer is known to the inventor, he will naturally prefer to proceed directly against him rather than go to the trouble and expense of suing a multitude of users who may be scattered over a wide extent of territory; and in the case where the manufacturer is not known and the inventor is unable to locate him, it is a manifest injustice to prevent him from taking action against the users and securing a just profit on his invention.

The third proposal, "to reduce the time to sixty days in which to file an application for a patent," is probably fraught with more mischief than either of the other clauses of the bill. Presumably, the sixty days count from the day of publication or public use, and if such a law were passed, it would prove to be a heavy drag upon the hitherto untrammeled march of invention in this country. If the introducer of the bill had any practical knowledge of the subject, he would have known that in the case of the majority of inventions sixty days would be all too short a time in which to test and improve a device before determining on its best mechanical forms and applying for a patent. Inventions are not turned out like bricks from a brick making machine. The process is laborious, painstaking and almost invariably protracted. From the first conception of the idea to its embodiment in a practical working shape is in most cases a period of months rather than of days, and many inventions are of such a kind that a public display of the device is a positive necessity during the experimental period. There are many inventions, such as those relating to public vehicles and conveniences, which can only be tested under the public eye, and to require that such experiments shall be privately conducted is to shut the poor man out of the field.

Although it may be true that for an inventor to let his device lie unpatented for a lengthy period, until others have unsuspectingly patented the same thing and spent money to put it in operation, may occasionally work a hardship, the remedy proposed in this bill is infinitely worse than the disease.

The bill has been referred to the Committee on Patents. There, we have no doubt, it will die a natural death. If it may have served "to point a moral" as to the folly of such legislative trifling as is involved in its presentation on the floor of the House, it will not have spent its brief life in vain.

ELECTRIC TRACTION ON STEAM RAILROADS.

The electrical equipment of a portion of the lines of the New York, New Haven & Hartford Railroad Company, the replacing on these lines of the steam locomotive by the electric motor and the third rail, will mark an important epoch in the history of electric transportation. It was natural that the success of the electric motor on city and suburban lines should lead to an investigation of its fitness for the requirements of traffic on standard steam railroads. Indeed, it is a fact that electrical engineers in the first flush of their success did not hesitate to foretell the speedy relegation of the locomotive to the scrap heap, and it was not uncommon to hear enthusiastic promises of air line railroads with full sized trains running at speeds somewhere in the neighborhood of one hundred and fifty miles an hour.

It was not long, however, before the "facts and figures" of the cost of operation of electric roads, and a scientific analysis of carefully recorded data, proved that the new method of traction was governed by strict limitations, and that it could not be economically applied to the main lines of railroad for all classes of work in the present state of the art of electric traction. It was soon realized that for hauling trains on continuous long distance runs it was altogether inadmissible on account of the cost of transmitting the current, and that the shorter the runs and the more frequent the stops the more favorably did the electric motor compare in point of efficiency and economy with the steam locomotive.

The New York, New Haven & Hartford Railroad Company was quick to act in a matter which was likely to have an important bearing upon the interests of steam railroads. A large portion of their vast passenger traffic was of the local or short distance kind, and it was being seriously cut into by the many electric and trolley lines which had developed an active and successful competition during the past few years. The company resolved to carry out exhaustive experiments, to determine how far and in what manner it would be advisable to electrically equip those of their lines which were being subjected to the severest competition from parallel trolley roads. The experimental work was mainly carried out on what is known as the Nantasket Beach line, and for two years it has been prosecuted with the greatest care and diligence. An examination has been made of the best form of station equipment, transmission, and motors for this particular class of work, and the experience which was gained in this way has been embodied in the equipment of which we give a complete description on another page.

The opening of this line—or rather its reopening—cannot fail to exercise a powerful influence upon all the other great railroads which, like the New Haven road, are suffering from the competition of suburban and interurban trolley roads; and as soon as the new equipment shall have been long enough at work to prove the extent of its superiority to the old system, we may look for some at least of these roads to make a similar change of motive power.

Perhaps the most important point that the company has proved to its satisfaction is that the current may be safely and economically transmitted by means of a third rail laid between the main rails and carried by wooden blocks placed upon the ties. This arrangement did away with the costly, and, for this kind of service, somewhat wasteful overhead trolley wire, and removed at once an obstacle to the adoption of electric traction on trunk roads. There is no perceptible leakage from the third rail under ordinary conditions of weather, and the line has been operated when the whole track was covered with water. Add to this that the risk to the public has been reduced to a minimum by breaking the rail at crossings, fencing it in at stations, and making provision for cutting out the current while the train is stopping at stations, and it will be seen that a most serious problem has been very satisfactorily solved.

As regards the trains themselves, it has been proved that a given weight of passenger cars may be more quickly accelerated than the same weight of cars and steam locomotive combined. The immense advantage which this confers in the operation of a short distance traffic with numerous stops is obvious, and in this lies one of the greatest advantages of the new over the old system. There is also a smoothness of acceleration and an absence of smoke and cinders which conduce greatly to the comfort of the traveling public.

But while the company are satisfied that the system of electric traction which they have so successfully worked out has a great future in the particular branch of railroad service for which it is designed, there is a noticeable absence of any rash promises regarding its application to fast passenger traffic on the through lines. Whether we shall see the application of electricity to this service depends upon the developments which may be made in electric traction as such. In the present state of the art, the management of the great railroads consider that it is unsuited to long distance express service, and that until some more economical system of transmission is devised, it has little hope of being applied in that direction.

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OPENING OF PHILADELPHIA'S COMMERCIAL MUSEUM.

Philadelphia's Commercial Museum, in the Pennsylvania Railroad office, on Fourth Street, was formally opened on June 2, by President McKinley, in the presence of a gathering of notable persons from Washington, and representatives of the leading trade bodies of the United States, Mexico, Central and South America. The event really had international importance, owing to the presence of so many diplomatic representatives of other countries, especially those on the American continent. An inspection was made of the building and a luncheon was served. The formal opening of the museum was held at the Academy of Music at two in the afternoon. The mayor of Philadelphia presided and introduced President McKinley, who made a most excellent speech, after which Dr. William Pepper, president of the Commercial Museum, outlined the character and work of the museum. In brief, he stated that the Commercial Museum possessed the most extensive collections of natural products in existence in any country. These collections are displayed so as to enable manufacturers or traders to study them to the best advantage and gain the information or make the selections needed for their special interest. The library receives regularly over 900 journals of commerce and manufactures from all parts of the world in many languages. An abstract of contents is made on cards and they are duly catalogued. The museum also sends out numerous circulars of inquiry and regularly receives reports of special agents. The bureau of information thus formed contains the fullest and most exact data obtainable on trade conditions. The advantages are open to all manufacturers who pay the moderate membership fee. In the scientific laboratories connected with the museum all new products will be tested and analyzed, and the results are expected to be very valuable. Courses of instruction will be regularly conducted in the institution which will attract earnest students seeking to fit themselves for appointment in the consular service or to other commercial positions.

The purposes of the museum require further that there shall be displayed very complete collections of the manufactured articles which are actually being imported into the markets which it is proposed to share with the countries hitherto controlling them; consequently there will be found extensive series of goods made abroad for sale in Mexico, Central and South America, Africa, Australia and the Orient. It is hoped in time that permanent buildings may be constructed to house the collections, and that the federal government may take some definite official recognition in the form of an annual grant. The result of the three years' work has been most satisfactory.

THE NEW PUBLIC LIBRARY BUILDING COMPETITION.

The bill authorizing the building of the new Public Library building for New York City has been approved by the Governor. The estimated cost of the building is $1,700,000, exclusive of the heating, lighting, ventilating apparatus, furniture, book stacks, shelves, and also for the expenditure for architects' fees and for removing the reservoir. In a pamphlet issued by the trustees of the New York Public Library the various requirements of the building are specified. The building will stand on a lot 482 × 455 feet square. The building will measure about 225 × 350. It is to be fireproof and have a storage capacity for 4,000,000 volumes.

The committee proposes to obtain plans by two consecutive competitions; an open competition for sketches only and a restricted paid competition. Director J. S. Billings, Bernard R. Green, in charge at the Congressional Library, and Prof. Ware, of Columbia University, will be the judges in the preliminary competition. All architects having offices within the limits of Greater New York are invited to compete in the preliminary competition. The commitee will then choose from the work of these architects twelve sketches which in their judgment are the most meritorious. They will be given a premium of four hundred dollars. The committee will then choose from the authors of the twelve sketches so selected certain of the competitors, not more than six in number, to take part in the second competition, selecting only those who, in their judgment, are qualified by their professional training and experience to undertake so important a work. The persons thus selected will then be invited to take part in a second competition, which will be conducted under such conditions as the committee may name. The competitors in the second competition will be given eight hundred dollars as the estimated cost to them of the drawings required. These drawings will be judged by a jury of seven persons, consisting of three members of the board of trustees to be named by the board, the director, and three practicing architects, which may be chosen by the committee. The jury will, by a majority, select the designs, at least three in number, which they find, on the whole, to be the best, and will send them to the trustees, naming them in the order of their merit, with such criticisms as they see fit to make. The trustees will then send these to the Board of Estimate and Apportionment for its approval, subject to such changes as may afterward be deemed advisable, and the trustees will recommend the author of the best plans as the architect of the building. The trustees may also appoint an engineer to superintend the work.

Plans are now being perfected by Dr. Billings to systematize the three large collections with a view to their amalgamation in their new home. It will be at least three years, possibly more, before the collections can be housed under the same roof. It will take a large part of this time to go over the libraries thoroughly, classifying their treasures and have them put in proper shape for the final fusion. Already the collections are being consolidated. Thus the Americana will be taken to the Lenox Library, as will also the works on music. The works on sports and English history will be brought to the Astor Library. When the new library building is erected, the building of the present Lenox Library would make a magnificent home for the New York Historical Society or some other similar institution.

AN ELECTRIC FOUNTAIN FOR BROOKLYN, N. Y.

The city of Brooklyn is to have an electric fountain which will be erected in the Park plaza. Plans for the fountain were made by F. W. Darlington, Philadelphia, who has constructed fountains of a similar character in other cities. The old concrete fountain has been removed and the new fountain will take its place. The position is particularly fortunate, being exactly in front of the great arch at the entrance of Prospect Park. The circumference of the basin is 370 feet, and it will be constructed of kosmocrete. Under the center of the basin will be a cellar in which will be placed a large part of the scenery connected with producing the colored effects. A tunnel will connect this cellar with an operating kiosk, where the person in charge of the fountain will stand, looking out of a window six inches above the water, and thus be enabled to see the effect of the various combinations which he has caused to be produced.

The electrical apparatus will consist of nineteen automatic focusing arc lights, connected in series; each lamp will be of 6,000 candle power, and will be provided with an adjustable stand which permits of throwing the light upon the ascending water. Three rheostats will be provided, one for each series of lamps, and each lamp will be provided with a silver parabolic reflector.

The glass color slides will be operated by compressed air, and they will be controlled by electricity. Eighteen incandescent lights will be arranged about the wall of the basin.

The display of the fountain will consist of fancy jets, umbrella, ball sprays, rings, fans, funnels, wheat sheaves, etc. It is said that an attempt will be made to throw pictures on a wide sheet of spray. If the experiment is successful, it will be very interesting.

Two trolley car companies have entered into an agreement with the Park Commissioners to each supply one-half of the current required, and it is believed 100 horse power will be necessary.

The fountain is capable of throwing 100,000 gallons per hour. The contract price of the fountain is $24,500, and the contractors are the Willson & Baillie Manufacturing Company.

ACCIDENT AT THE YERKES OBSERVATORY.

The Yerkes Observatory of the University of Chicago, at Williams Bay, Wis., will be closed for the summer on account of an accident which occurred on May 29. The great movable floor of the great dome fell 45 feet and rested at an angle of 45 degrees, with one edge of the floor against the bottom of the pit and the other edge 3 feet below the top gallery, against the guides which carry the great counterweights. It appears from an examination made by an engineer that one of the cables was torn from its weight. This unbalanced the floor, which fell to the bottom of the pit. In its fall it carried away the winding stairway and crushed the electric apparatus underneath it. The floor is said to be a complete wreck. There was no one in the building at the time of the accident. Prof. Barnard and Prof. Ellerman had been working all night at observations, but they had stopped at daylight, so that, fortunately, no one was injured. Director Hale at once locked the building, and sent to the University officers to come to the building and commence an investigation. "The cause of the accident," said Major Rust, Comptroller of the University, "has not been decided, and probably will not until representatives of all the parties interested are on the ground. The big telescope was not injured in the falling of the floor in the least, and the damage is confined to the floor itself and the machinery immediately connected with it. As to how the accident occurred we have not come to a conclusion. I think the floor will be again in position inside of sixty days." The results of the official investigation will be looked for with interest.

CHELSEA district in London utilizes its street refuse by separating the rags and paper, which are converted into brown wrapping paper, while the rest of the refuse is burned in the furnaces of the reducing works and the residuum is used in brickmaking.

AN IMPORTANT FIND OF ANCIENT PAPYRI.

A great find of ancient papyri in Egypt has been made by Messrs Grenfell and Hunt, who are exploring for the Egyptian Exploration Fund at Behneseh; many ancient rubbish mounds yielding a rich store. The quantity of rolls found in three of the mounds was large enough to warrant the assumption that a part of the archives had been thrown there. The papyri range from the time of the Roman conquest to early Arab times. Each century is largely represented. Most of the documents are written in Greek, with a sprinkling of Latin, Coptic and Arabic. Little is known of the contents of the documents, but Mr. Grenfell's hope in digging at the site of Oxyrynchus of finding early Christian documents is realized, for among the papyri is a leaf from a third century papyrus book containing a collection of the sayings of Christ. Some of the sayings are not in the Gospel and others exhibit diversions from the text of the Gospels. It is thought that, when the papyri are examined in detail, further discoveries of Christian records, as well as fragments of lost classical literature, will be found, since in some of the mounds a large proportion of the papyri are written in uncials, which were largely employed during the first two centuries of the Christian era. One hundred and fifty rolls which in many cases are several feet long have been retained in Gizeh and the rest are on the way to England. Besides the papyri, a number of coins, two hundred inscribed tiles, bronze and ivory ornaments and other objects of the Roman and Byzantine periods have been recovered. The New York Sun deserves credit for cabling all the details obtainable of the find.

THE HARTFORD MEETING OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

The opening session of the Hartford meeting of the American Society of Mechanical Engineers was held on May 25. Sessions for the reading and discussions of papers were held on Wednesday, Thursday and Friday mornings and Friday evening. The afternoons were devoted to excursions to interesting shops, institutions, etc., in the neighborhood. On Wednesday, May 26, a reception was given by the President and Faculty of Trinity College. A large number of interesting papers were read, including one by Dr. Leonard Waldo, on the "History of the Development of the Bicycle;" "Hygrometric Properties of Coal," by Prof. R. C. Carpenter; "Electricity vs. Shafting in a Machine Shop," by Prof. Charles H. Benjamin; "Rating Electric Power Plants on the Heat Unit Standard," by Prof. William S. Aldrich; "A Continuous Steam Engine Indicator," by Prof. Thomas Gray. These were only a few of the very interesting papers which were read. The members of the society were well entertained in Hartford, and the excursions in the neighborhood were very interesting.

Among the excursions were trips to visit the third rail system of the N. Y. & H. R.R., the plant of the Berlin Iron Bridge Company, the Pope Manufacturing Company, the Pratt & Whitney Company, the Billings & Spencer Company, the Hartford Rubber Works and other establishments. The Hartford meeting of the society was the largest ever held outside of New York City, 402 members and guests being registered as in attendance. The legislature being in session at the time, the hotels could not accommodate the crowd, so that many members were able to enjoy the hospitality of some of Hartford's homes.

THE LIQUEFACTION OF FLUORINE.

The distinguished chemist Prof. James Dewar has just succeeded in liquefying fluorine gas at a temperature of —185° C. The product was a yellow mobile liquid which had lost chemical activity. Great interest has been felt in the element fluorine since its isolation by M. Moissan, who described it in his celebrated paper in the Annales de Chimie et de Physique for December, 1887. The isolation of flourine was described in detail in the issue of the SCIENTIFIC AMERICAN SUPPLEMENT, January 22, 1887. Further researches upon the element were given in the same paper for December 12, 1891. The element exists in a considerable quantity in combination with calcium, forming the mineral fluorspar, which crystallizes in fine cubes of various colors. Flourine also occurs in small quantity as a constituent of bone and other animal substances. Its intense affinity for metals and for silicon for a long time prevented the attempts to isolate it from being successful. The efforts of the chemists to investigate it in a satisfactory manner were baffled, because its chemical affinities were so numerous and acute that, when driven from one combination, it instantly combined with some other substance with which it came in contact. Owing to this difficulty of investigating its qualities, there has been some uncertainty as to its elementary nature. It is probable that Prof. Dewar's discovery will be of great importance, from the fact that the liquefied gas loses its chemical activity. Full details of Prof. Dewar's discovery are at present lacking, as only a cablegram was received at the time of going to press, but further particulars will be looked for with great interest.

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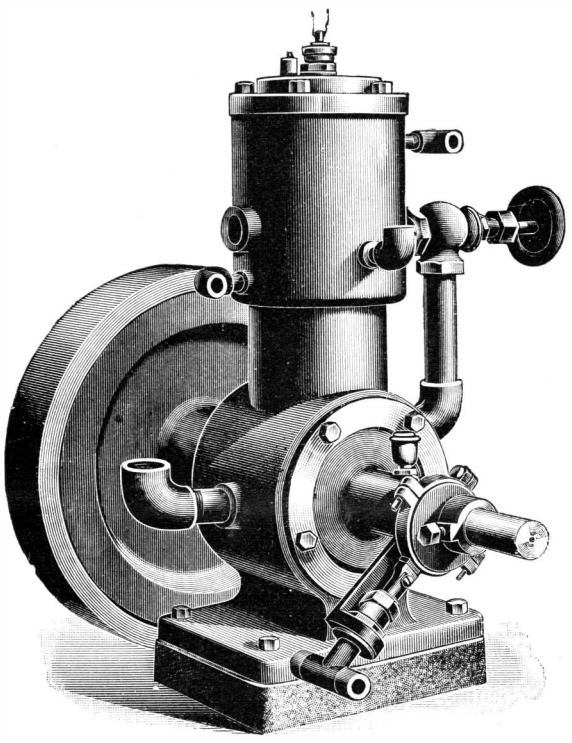
NEW GAS MOTOR.

We give herewith an engraving of a new vertical gas and gasoline engine, recently brought out by Palmer Brothers, Mianus, Conn., with a view to furnish the complete engine or castings with working drawings for amateurs and others desiring to construct an engine.

It is suitable for running light machinery, when arranged as a stationary engine. The marine type (which



SMALL GAS AND GASOLINE MOTOR.

is shown in the cut) will run a 16 or 18 foot boat or light motor carriage. It will run in either direction.

A pump is used to circulate water in the water jacket of the portable engine. In the stationary form a tank is used instead of a pump. These motors are built on the two-cycle compression system, with an impulse at each revolution of the crank. It receives its charge and exhausts through a cylinder port opened and closed by the movement of the piston. A suitable valve regulates the charge received from the closed crank chamber in which the mixture is compressed by the downward stroke of the piston. Vapor and air are drawn into the crank case by the upward stroke of the piston, and thoroughly mixed by the motion of the crank. The engraving shows the circulating pump, but the pipe leading from the pump to the water jacket is omitted.

The weight of the marine engine is 135 pounds; of the stationary, 200 pounds. The height of the stationary engine is 23 inches and that of the marine is 17 inches. The height from the base to the center of the shaft is 4½ inches.

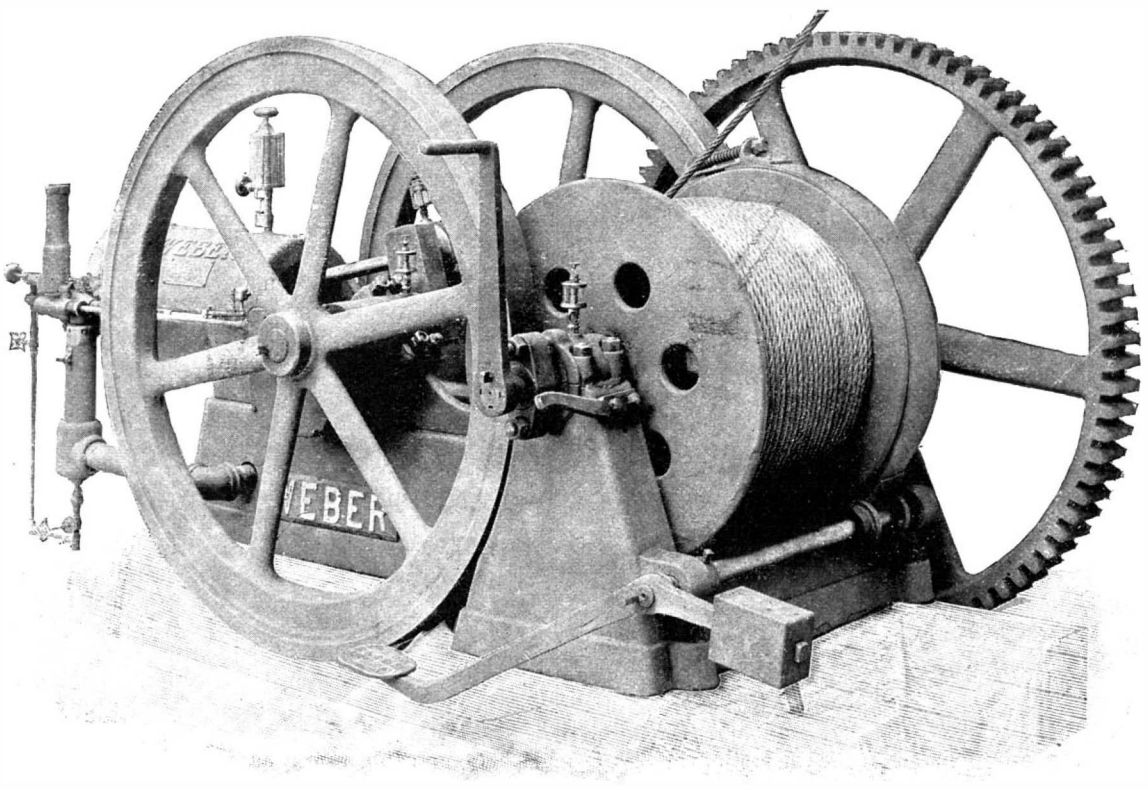
GASOLINE OR GAS HOISTING ENGINE.

The facility with which gas or gasoline engines can be adapted to different uses and the extent to which these motors have been introduced into new fields is remarkable. The latest application of the gas and gasoline engine is shown in our illustration. It is a hoisting engine in which the gas or gasoline motor and the hoisting mechanism are mounted on a single rigid base. The hollow cast iron drum which turns on its shaft is carried by an internal wooden frictional driving device, and the power is transmitted from the engine shaft to the hoisting shaft by heavy spur gearing. The drum is provided with a steel strap brake, and both clutch and brake levers are placed in convenient positions. The motor has a special governor which enables the user to change the speed to suit the work to be done.

The machines are made in sizes ranging from ten to fifty horse power. They are simple in construction and adapted for all uses, but are especially suited to mining localities where water is scarce and fuel expensive. The use of these machines permits of working many mines which could not be worked if steam were the only motive power available. Either gas, gasoline, crude oil or distillate can be used. The manufacturers of these engines furnish a special driving pulley when desired which allows of using the engine for driving ventilating or forge fans, pumps or other machinery when it is not used for hoisting.

The hoister is compact, economical and safe; it can be managed by any one, and, as in the case of all gas engines, expense ceases when the engine stops.

The Weber Gas and Gasoline Engine Company, Kansas City, Missouri, are makers of this machine.



NEW HOISTING ENGINE.

The Care of Watches.

There are a great many little superstitions connected with the handling and wearing of watches, as with everything not commonly understood. How many owners of timepieces are very wary about leaving them with a watchmaker, lest some of the "jewels" may be abstracted! If these people only knew that the most precious jewels in the ordinary watch are worth about eight cents apiece, and only about forty cents a gross unset, their alarm would vanish; but they would also look upon their watches with a great deal less of mystic veneration and awe.

Another common belief is that turning the hands backward will injure the works. How, they do not know—but in some mysterious manner that ordinary mortals cannot comprehend, In fact, the only style of watch which could have been injured in this way is the old English "verge" escapement, modeled after fourteenth century clocks—watches which almost anything would have injured, and which were useful for almost any purpose except keeping time.

A watch is a complicated piece of mechanism—the least elaborate have a hundred and fifty separate parts, some over a thousand, every part nicely adjusted to its delicate functions. And the movements never stop, unless the watch's owner neglects the important precaution of winding it, or, on the contrary, is so very solicitous about its welfare that he attempts to remedy the defects of its anatomy by surgical operations with a penknife, a pin, a lead pencil, or some other instrument as inappropriate.

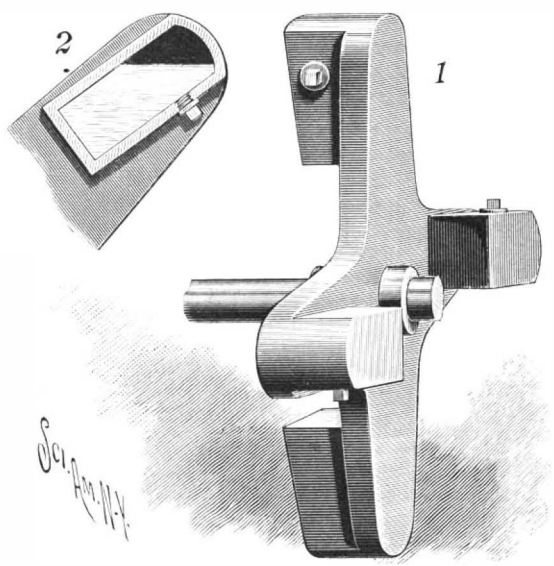
Wind your watch regularly. That is the first great rule for watch wearers. In the morning is probably the best time, so as to have the greatest tension of the spring during the day, when the works are most liable to shaking and hard usage. Have your watch cleaned and oiled regularly. The delicate balance wheel makes 150,000,000 vibrations during a year. The best oils will gum and clog where there is such continued friction.

Keep your watch pocket clean. Don't let lint and fine dust accumulate in the corners. No matter how well the cases may close, the subtile dust will work its way through soon enough.

Chief of all, curb your curiosity. Don't open the cases and inspect the works. They are there yet, even though you have not seen them since yesterday. If anything should occur to cause them to stop, don't try to find out yourself what it is. A watchmaker will charge you nothing for an accurate diagnosis, which involves no possible further injury. And don't try to regulate the watch yourself. You may do it successfully, but the chances are against you. In fact, the chances are that the watch may not need regulating at all. All watches, except the best, run faster in winter, slower in summer. Yet some men set their watches with every clock they see, and move the regulator, too, if they can pry the cases open.—Popular Science News.

A NOVEL SHAFT BALANCE.

A balance more especially designed for use on pumps and other manually operated machines, to counterbalance any wheel or wheels on the shaft, is shown in the accompanying illustration, the device being designed to permit the operator to start the shaft and actuate the machine with great ease. The improvement has been patented by A. S. La Fontaine, of the Aruba Phosphaat Maatshappy, Curacao, Dutch West Indies. On the driving shaft of the machine on which the balance is to be applied is a spider with radial arms supporting at their outer ends closed boxes, as shown in Fig. 1, each provided with a filling plug to permit of placing water or other liquid in the boxes, as indicated in Fig. 2. The boxes are arranged alternately on opposite sides of the arms, and by partly filling the boxes a running weight is formed for the arms of the spider, designed to be free from all jerk or jar, as is so frequently the case with balance wheels for sliding weights, the construction also dispensing with a rim, and calling for less weight and bulk than a fly wheel.



LA FONTAINE'S SHAFT BALANCE.

The Alleged Occurrence of Frogs in Blocks of Stone.

The occurrence of living frogs and toads inclosed in blocks of rock or stone or in clay, many feet below the surface of the ground, has often been reported, but never substantiated, says Leisure Hour. Dr. R. H. Traquair, keeper of the Natural History Collection in the Museum of Science and Art, Edinburgh, has examined this delusion, among others, and he puts all such reports down to want of power of accurate observation. A stone is being broken, a frog is seen hopping about close to the place, and forthwith the lively imagination of the quarryman persuades him that he has seen it actually come out of a cavity in the rock. Dean Buckland made experiments for the purpose of ascertaining how long frogs and toads could live shut up in cavities of stone and excluded from air and food, with the result that most of them were dead within a year, and none survived more than two years. Yet frogs are alleged to have been found inclosed in rocks which, geology teaches, were deposited under water millions of years ago, and afterward subjected to a pressure which has crushed all the fossils contained in them as flat as paper. If geology is right, the frog stories are utterly incredible. Or, as Dr. Traquair puts it, the blow of the hammer that disclosed a live frog inside a block of stone without an opening would at the same time destroy not only geology but the whole fabric of natural science.

ON the death of the Duc d'Aumale, on May 7, the Institute of France comes into possession of the splendid Château of Chantilly, with its splendid collection This bequest is valued at $8,000,000. The collections will now be opened to the public and a rare treat is in store for those who make the pilgrimage to the famous château. The exterior wings of the château are assigned as lodgings for the three curators. To meet the expenses of the preservation of the château, the great forest is included in the bequest. The funds obtained from annual clearings and from the income of other portions of the estate will produce more than the sum necessary for keeping up the château.

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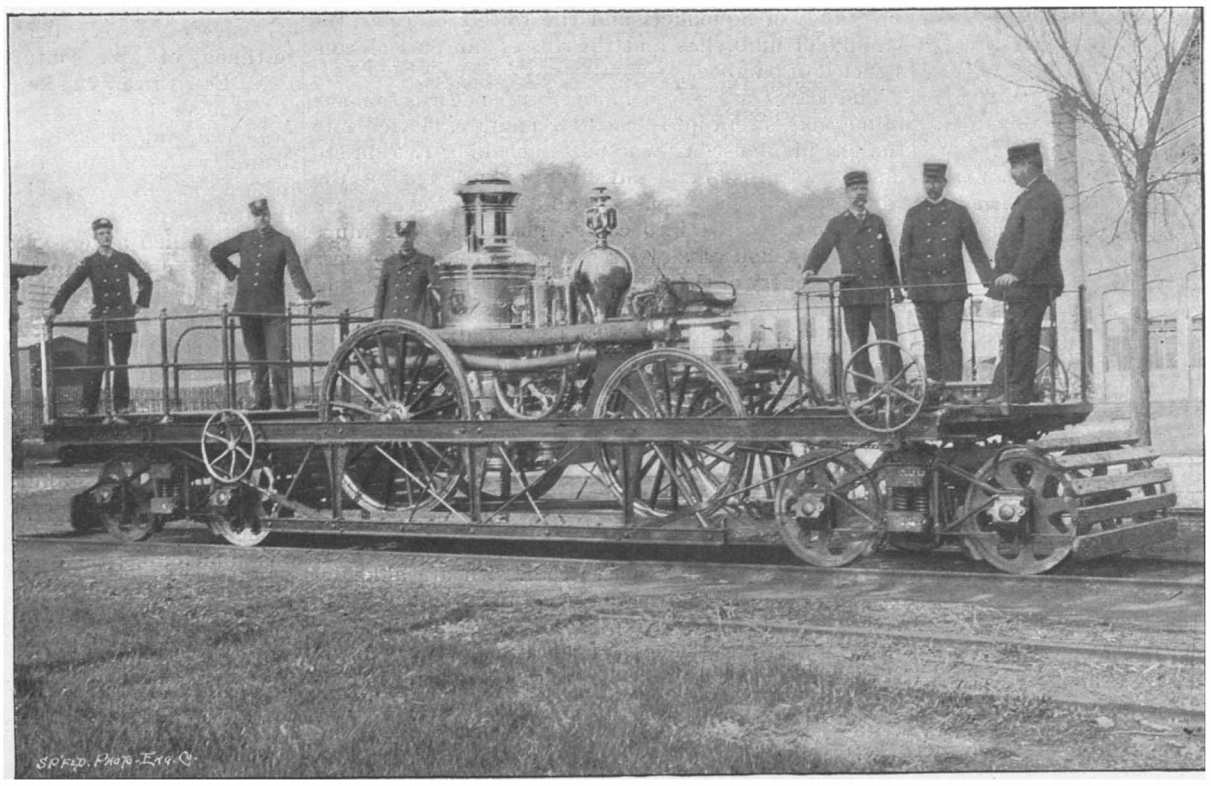
A FIRE ENGINE CAR.

With the enormous extension of the trolley road it has been rendered possible to furnish fire protection to outlying districts without the maintenance of expensive fire companies in the immediate neighborhood. Several cases have lately occurred in which the trolley has enabled fire apparatus to be quickly transferred to the scene of the conflagration.

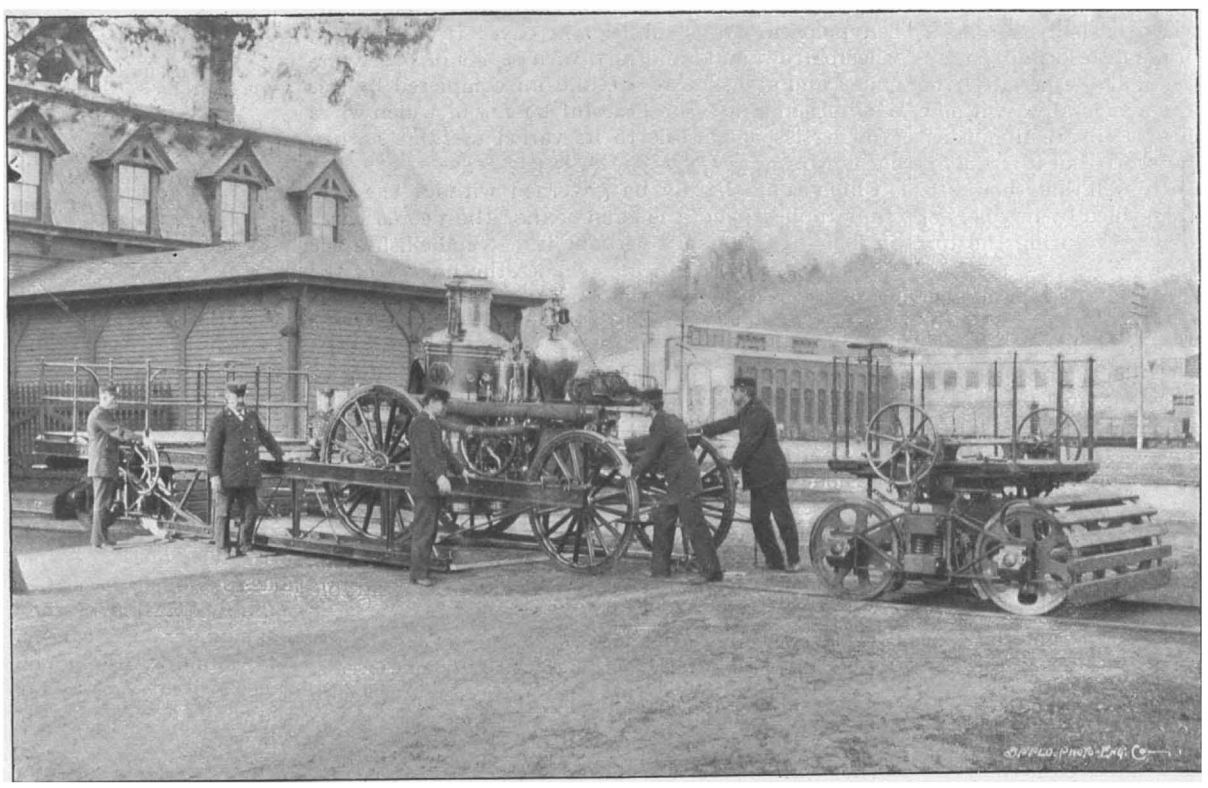
The electric engine truck which we illustrate is intended for this purpose, and is made by the Wason Manufacturing Company, of Springfield, Mass. It consists of two trucks, surmounted by platforms, on which men can ride with hose, tools and other equipments. To the rear truck is attached a platform which connects the two trucks upon which the fire engine is carried. The length over the platform railings is 28 feet 8 inches. The extreme length from the edge of the footboard to the fender is 30 feet 10½ inches. The height from the rail to the top of the engine platform is 9½ inches, the length and width of the engine platform is 13 feet 9 inches by 6 feet 11 inches. The width of the car over the channel beams is 7 feet 10 inches. The extreme width over the hoisting wheels is 8 feet 6½ inches. The weight of the car is 14,000 pounds. The electric motor can be attached directly to the axle of either truck or the car propelled or drawn by electric locomotive or snow plow.

To load the engine, the platform is lowered to the rail, the front truck is disconnected, and is run far enough away to admit of the engine being backed into position, when, by means of a winch attached to the rear truck, the engine is easily and readily drawn into place. The front truck is then brought back, and, by means of chain hoists operated by right and left screws, the front end of the platform is raised and the side girders securely locked into place, thus making both trucks and platform practically one piece. At a recent test by fire department officials, a steam fire engine was loaded in two and one-quarter minutes from the time the car was run into position until its being ready for service. In unloading, the front truck was detached in forty-five seconds, and the horses were attached and ready for starting off in one minute and one-quarter.

The great extension of the trolley and third rail roads in connecting widely separated towns will enable such fire trucks to be used with great effect, as, in case of a serious fire, engines from a number of towns may be brought into action in a very few minutes, and will enable small hamlets and isolated houses to receive fire protection which they could not get in any other way.



AN ELECTRIC FIRE ENGINE TRUCK.



LOADING THE TRUCK WITH A FIRE ENGINE.

The Creep of Rails.

A valuable paper upon the above subject was presented recently before the railway section of the Austrian Society of Engineers, by Inspector Von Engerth, and is now printed in full, with diagrams, in the Zeitschr. d. Oesterr. Ing. u. Arch. Vereines for January 22 and 29, says the Engineering Magazine. The fact that rails do creep has long been observed, but this shifting of position appears to be a final resultant of so many different causes that its full investigation is voluminous. Inspector v. Engerth has collected data from a number of the Continental railways, and from these he studies the problem. Especially is he indebted to M. Couard, of the Paris-Lyons-Mediterranée railway, and to the report of Herr Ast upon Austrian railways.

In most of the roads investigated the creep was in the direction of the travel of trains, and also down the grades, as might be expected. The greatest creep observed was that on the Kaiser Ferdinands Nordbahn, where the maximum was 260 millimeters in one year, but this was exceptional, as on the same road the total creep for seven years was 420 millimeters. The creep, however, takes place on straight, level sections of the road, and, furthermore, is not alike for both rails, the left rail almost invariably showing the greater creep.

Careful measurements were made upon about 500 miles of the Austro-Hungarian state railways, of which more than 300 miles are double track, and data were obtained upon the following points: nature of ballasting, relative level of rails, width of embankments, character of rail fastenings, length of time in which no creep occurred, and other special points that presented themselves.

M. Couard in his investigations found that in double track roads the creep was in the direction of train motion, and explains this action as follows:

When the engine wheels approach the end of a rail, the weight of the engine causes the rail to spring down a little lower than the end of the next rail, which has as yet none of the weight upon it. This causes the wheel to strike a blow upon the end of the rail which is being approached, and the horizontal component of this blow acts to drive the rail along in the direction of the motion of the engine. The greater creep of the left rail he explains by the fact that on the Paris-Lyons-Mediterranée road, on which the trains keep to the left, the outer rail, being further away from the center of the roadbed, is not so well supported as the inner rail, and hence suffers greater deflection. For single track sections, the creep appears to be in the direction of the swiftest trains or the heaviest loads, thus bearing out the same theory.

The investigations in Austria, however, did not altogether support this view. Herr Spitz, who assisted in making the examinations, found that the greater creep of the left rail also appeared on the Hungarian roads, on which the trains keep to the right, the left rail being in the middle portion of the roadbed, showing that some other cause must be found to explain the inequality. Local conditions, such as difference in ramming the ballast, unequal depth, etc., were found to cause unequal creep, and in some instances the creep was less down steep grades than on portions more nearly level.

Herr Spitz, to whom the credit for the second portion of the paper is due, thinks that the true cause of the unequal creep of the rails is the action of the forces in the engines; he contributes an elaborate discussion of the successive impulses tending to produce blows upon the rails. Taking each side separately, he plotted the successive phases, and then, combining them into one diagram, showed the resultant to be in accordance with the observed facts.

It would be interesting to apply the same analysis to the observations made in this country, and thus obtain a confirmation or refutation of this result.

Gila Monsters Venomous.

Prof. John Van Denburg delivered an interesting lecture at the Academy of Sciences, San Francisco, recently upon the Gila monster. He says:

"It has become a common supposition for years," said the lecturer, "that the bite of a Gila monster was as poisonous as that of a rattlesnake, but many of the scientists denied this. Numerous eminent scientific men stated that from actual experience they had demonstrated that the bite was harmless. One of these (Dr. Schufert) had himself been bitten by one of the reptiles, and, besides the pain occasioned by the ordinary bite of an animal, no ill results followed."

The lecturer then stated, says the San Francisco Call, that he had demonstrated that the saliva of the Gila monster was poisonous. Its bite would in almost every case cause death, if the teeth of the lower jaw penetrated the skin. It was the upper jaw of the reptile which sank into the flesh of Dr. Schufert, and as the secretion of the glands of the upper jaw was harmless, the doctor lived.

The speaker said that he had injected the saliva of both the upper and lower glands into pigeons, and in every case where that from the lower jaw was injected the victim had died in a short time. He showed why so many animals which are bitten by the poisonous reptile live. The ducts which lead from the glands to the mouth open between the lower lip and the gum. For the saliva to enter a wound it must be forced up from the lip to the teeth, and thence into the wound. Thus it is hard for the poisonous fluid to reach the blood, even if the victim is bitten by the lower teeth.

On the occasion of its 150th anniversary the Aberdeen Journal boasts that it was founded by a fellow apprentice of Benjamin Franklin. The first number contained an account of the battle of Culloden. The Journal was a weekly till 1876, when it became a Conservative daily.

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Natural History Notes.

Radiography of Flower and Fruit Buds.—In a recent number of the Gardeners' Chronicle, Mr. G. J. Burch contributes an interesting article, accompanied with figures, upon the use of the X rays for photographing flower and fruit buds. Mr. Burch and his assistants began by exposing plates of glass of different colors to the action of the rays. The violet glass showed itself much more opaque than that of other colors. It contained alumina and cobalt in addition to the ordinary elements. An experiment was afterward made with a violet colored hyacinth, and, as had been anticipated, the flower gave different results from those given by the glass. It was much more transparent. The sensitized plate, after development, showed that the contour of the petals, the veins, and the internal form of the ovary were well represented. For taking such radiographs Mr. Burch advises the use of tubes that give very little light, and that, for example, would scarcely give the contour of the hard parts of the hand. The aeriferous tissues are very transparent to the X rays. The more water the tissues contain, the more opaque they are. Dry fruits and flower buds give excellent radiographs. The seeds are very distinctly seen, as are also the different parts of the flower.

The Color and Sleep of Fish.—Prof. A. E. Verrill recently communicated to the American Journal of Science a valuable article on the subject of the color that fish assume while asleep. In most cases the change consists in an intensification of the colors. The markings have a darker appearance, and such modification is of a nature to better conceal the animal and render it less visible during the night. In certain of the species observed by Prof. Verrill the changes were more complicated. For example, the Stenotomus chrysops while awake and in a state of activity was silvery white, with iridescent plays of color. At night it was of a dark bronze color, and from this ground stood out six transverse black bands. If it chanced to be awakened from its sleep at night, in an aquarium, by the sudden turning on of the gas, so that the light was bright, the color was instantly modified, and the normal tints of the awakened animal exhibited themselves immediately. Here again the protective role of the coloration of the sleeping state is evident, since the animal sleeps among algæ and the black bands are confused with the thalli and fronds, while the bronze color closely resembles the greenish yellow color common to many seaweeds.

In the monacanthus also the nocturnal color is very different. The animal is brown and greenish when it is awake, while when it is asleep its body assumes a grayish color, which protects it amid rocks and plants. In the cephalopods, too, in the loligo especially, the nocturnal color is darker, and, in a general way, it may be said that the animal is less easily distinguished when asleep upon the rocky bottoms that it frequents than when awake. It is evidently well that this is so, since an animal too easily distinguished by its colors or markings would become an easy prey during the torpidity of sleep.

The Preservation of Animals.—In a recent number of Natural Science there is given a summary of the observations of Mr. Amyrald Haly, director of the Museum of Colombo, upon the value of formaline as an agent for preserving zoological specimens. According to Mr. Haly, who has been using this material for the last two years, a 1½ or 2 per cent solution suffices to preserve the invertebrates in general. For the vertebrates it requires a 3 or 3½ per cent solution. Formaline preserves the medusæ admirably, their colors and transparency remaining unchanged. Mr. Haly confesses, however, that formaline is not of universal application, for sometimes it fails. For fish of bright colors it is better to use gum and glycerine, and the same is the case with crustacea; but perhaps gum and formaline mixed might be used with advantage.

The Age of Trees.—It is a widespread idea that the rings of the section of a tree give data as to its age, the concentric rings being of the same number as the years that have passed. It is known, however, that the data thus furnished are only approximately exact. Can any other information be obtained from them? An English botanist has recently caused some surprise by calling attention to a peculiarity of a tree of which a section exists in the British Museum. This section is that of a Douglas fir which was felled in 1885, and was more than five hundred years old. An examination of the specimen shows that a part of the annual rings, corresponding to the end of the first century of the tree's existence, presents an abnormal appearance. Twenty of these rings are very close together and form a zone of special aspect, and widely separated from the external and internal zones. It is evident that these layers have formed during twenty years under defective conditions, or at least abnormal ones. What were these conditions?

The gentleman above mentioned is inclined to seek them in numerous cataclysms—earthquakes, inundations, drought, etc., with pernicious vapors coming from thousands of abysses, and such as preceded the great epidemic known in the fourteenth century as the black plague, which was attributed to such cataclysms.

Economic Uses of the Bamboo.—The bamboo may well be called useful, since it is applied by the Chinese to so vast a variety of purposes that they are puzzled to get along without it when they emigrate to a place where it does not grow. The tender, but tasteless, shoots are cut for food, and are either boiled, pickled, or comfited. The seeds furnish a farina suitable for cakes. The gnarled roots are carved into fantastic images of men, birds, monkeys, or monstrous perversions of animated nature; cut into lantern handles or canes, known in commerce as "whangus;" or turned by the lathe into oval sticks for worshipers to divine whether the gods will hear or refuse their petitions. The tapering culms are used for all purposes that poles can be applied to in carrying, supporting, propelling, and measuring, by the porter, the carpenter, and the boatman, in all cases where strength, lightness, and length are requisite. The joists of houses and the ribs of sails, the shafts of spears and the wattles of handles, the tubes of aqueducts and the rafters of roofs, the handles of umbrellas and the ribs of fans, are all constructed of bamboo.

The leaves are sewed in layers upon cords to make rain cloaks, swept into heaps for manure, matted into thatches, and used as wrappers in cooking rice dumplings. Cut into splints and slivers of various sizes, the wood is worked into baskets and trays of every form and fancy, twisted into cables, plaited into awnings over boats, houses, and streets, and woven into mats for the scenery of the theater, the roofs of houses, and the casing of goods. The shavings are even picked into oakum and mixed with those of rattan to be stuffed into mattresses. The bamboo furnishes material for the bed and the lounge, chopsticks for use in eating, pipes for smoking, flutes to aid in singing, curtains to hang in the doorway and brooms to sweep around it, besides screens, stools, coops, stands, and other articles of convenience and luxury in the house too numerous and trifling to mention. The mattress to lie upon, the chair to sit upon, the table to dine from, food to eat, and fuel to cook with are alike derived from it. The ferule to correct the pupil and the book he studies both originate here. The tapering tubes of the native organ and the dreaded instrument of the lictor, the skewer to pin the hair and the hat to screen the head, the paper to write upon, the pencil to write with, and the cup to hold the pencils; the rule to measure lengths, the cup to gage quantities, and the bucket to draw water; the bellows to blow the fire, and the tube to hold the match; the bird cage and the crab net, the life preserver and the children's buoy, the fish pole, the water wheel and eaves trough, sedan, wheelbarrow, and hand cart, with scores of other machines and utensils, are one and all completed by this magnificent grass, the graceful beauty of which when growing is comparable to its varied usefulness when cut down.

China could hardly be governed without the constant application of the bamboo, nor the people carry on their daily pursuits without it. It embellishes the garden of the patrician and shades the hamlet of the peasant; it composes the hedge that separates the grounds of the latter, assists in the construction of the implements to work their lands, and feeds the cattle that labor on them. The boatman, dyer, and weaver find its slender poles indispensable in their trades, while there is nothing that the artists paint so well on wares and embroideries. The tabashur found in the internodes has its uses in native pharmacy, and the silicious cuticle furnishes the engraver a good surface for carving and polishing.

The Boreal Fauna.—The intense cold of the regions near the north pole seems to form an insurmountable barrier to animals.

The sailors of the Fram, who proceeded as far as to the 85th degree of latitude, met with no whales, seals, mooses, or bears beyond the 83d degree. On the contrary, they observed dog fishes (Scymnus glacialis) as far as to the 85th degree.

The bear proved a valuable resource to them. Its flesh, cooked or raw, and its fat, served as food, while its skin furnished clothing. During the three years that the voyage lasted, the crew of the Fram killed twenty-nine of these animals.

Trees as Habitations.—Man, like certain animals, has sometimes availed himself of trees as a dwelling or a home. Lucinius Mutianus, an ex-consul of Lycia, took special pleasure in feasting twenty-one guests in a hollow plane tree; and modern travelers tell us of a gigantic baobab in Senegambia, the interior of which is used as a public hall for national meetings, while its portals are ornamented with rude, quaint sculptures cut out of the still living wood. The fig tree of India is worshiped as sacred, and the lazy, helpless bonze builds himself a hut, not unlike a bird cage, in its branches, where he spends his life dreaming in contemplative indolence under its cool, pleasant shade. Whole nations live in the branches of trees. There is a race of natives west of the mouth of the Orinoco, in South America, the Guaranis, who have never yet been completely subdued, thanks mainly to their curious habitations. Humboldt tells us that they twine most skillfully the leaf stalks of the Mauritius palm into cords and weave them with great care into mats. These they suspend high in the air, from branch to branch, and cover them with clay. Here they dwell, and on a dark night the bewildered traveler may see the fires of their dwellings high in the tops of lofty trees.

More civilized countries even have not left us without similar, though isolated, instances of men who have found a dwelling in the trees of the forest. Evelyn tells us of the huge trunk of an oak in Oxfordshire which long served as a prison for felons; and he who lived in the shades of old Selborne mentions an elm on Blechington Green which for months gave reception and shelter to a poor woman whom the inhospitable people would not receive into their houses.

How Our Ancestors Regarded Water Drinking.

Water was in no great favor as a beverage in the sixteenth and seventeenth centuries. The Hospital says: "It needed a very bold man to resist the medical testimony of three centuries ago against water drinking. Few writers can be found to say a good word for it. One or two only are concerned to maintain that 'when begun in early life, it may be pretty freely drunk with impunity,' and they quote the curious instance given by Sir Thomas Elyot in his 'Castle of Health,' 1541, of the Cornish men, 'many of the poorest sort, which never, or very seldom, drink any other drink, be notwithstanding strong of body, and like and live well until they be of great age.' Thomas Cogan, the medical schoolmaster of Manchester fame, confessed in his 'Haven of Health,' 1589, designed for the use of the students, that he knew some who drink cold water at night or fasting in the morning without hurt; and Dr. James Hart, writing about fifty years later, could even claim among his acquaintances 'some honorable and worshipful ladies who drink little other drink, and yet enjoy more perfect health than most of them that drink of the strongest.' The phenomenon was undeniable, but the natural inference was none the less to be resisted. Sir Thomas Elyot himself is very certain, in spite of the Cornish men, that there be in water causes of divers diseases, as of swelling of the spleen and liver. He complains oddly also that 'it flitteth and swimmeth,' and concludes that 'to young men, and them that be of hot complexion, it does less harm, and sometimes it profiteth, but to them that are feeble, old and melancholy, it is not convenient.' 'Water is not wholesome cool by itself for an Englishman,' was the verdict of Andrew Borde—monk, physician, bishop, ambassador and writer on sanitation—as the result of a life's experience. . . . But the most formal indictment against water is that of Venner, who, writing in 1622, ponderously pronounces to dwellers in cold countries it doth very greatly deject their appetites, destroy the natural heat and overthrow the strength of the stomach, and consequently confounding the concoction is the cause of crudities, fluctuations, and windiness in the body."

The Washington Monument's Seismoscope.

The largest seismoscope in the world hangs through the center of gravity in that great obelisk which was erected at Washington, D. C., in honor of our nation's first ruler.

This instrument consists of a copper wire 174 feet long which holds a plummet suspended from its lower extremity into a vessel of water. Two transits arranged at right angles to each other are focused upon the wire just above the plummet, and by means of these little telescopes the slightest vibration of this great mass of stone is indicated upon a graduated scale.

The expansion of the monument's south face, on a hot summer day, sometimes shifts the apex northward a few hundredths of an inch, and high winds frequently cause a slight variation from the normal position of the wire. Occasionally the plummet swings violently when the weather is calm and cool, its motion under such circumstances being ascribed to vibration of the earth itself.

The custodian of the monument takes a daily statement of the transits and prepares a monthly chart of the same, which is filed in the War Department. An examination of these records discloses the interesting fact that no permanent change has been effected in the position of the monument, the plummet having always leaned toward its normal resting place when the causes of disturbance subsided.

On Aconcagua's Summit.

A dispatch from Buenos Ayres, dated May 15, 1897, states that another member of the Fitzgerald expedition, Mr. Stewart Vines, has reached the summit of Aconcagua. It is said to be the highest mountain in the Western Hemisphere. This makes the second person who has ever made the ascent, the first being Zurbriggen, a Swiss guide, also a member of the Fitzgerald expedition, who made the ascent on January 14 of the present year. Mr. Vines reports having made several geological discoveries of great importance. Mr. Fitzgerald, the head of the expedition, is now preparing to make the ascent.

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Artificial Light: Modern Methods Compared: Electric, Incandescent, Welsbach, Acetylene.*

BY PROF. D. S. JACOBUS, STEVENS INSTITUTE OF TECHNOLOGY, HOBOKEN, N. J.

Experiments were made showing the appearance of colors when viewed under the various lights. Some colors were shown more perfectly under one light and some more perfectly under another. The Welsbach lamp failed in showing delicate shades of pink, and an experiment was made to show that it tended to give a yellow tinge to the complexion, whereas the acetylene light gave an effect much more life-like than the Welsbach lamp.

To show the appearance of various colors when viewed by the different lights, two surfaces of the same color were held up at an angle between two sets of light, each set containing eight lamps or burners. The two sets of lights to be compared were placed at a distance of about six feet from each other on the lecture table. Screens were placed in front of the burners to shield the eyes of the audience from the direct glare of the lamps. In the space between the lamps colors were shown on large pieces of cardboard, doubled over at the middle so that the two sides could be held at an angle to each other. This allowed one surface to be illuminated by one set of lamps and one by the other. The audience could observe each surface at the same time and thus compare the colors as they appeared to the eye.

Similar experiments were made before the lecture, in which the various lights were compared directly with daylight. These also showed that the Welsbach lamp failed in bringing out delicate shades of pink.

A second series of experiments consisted in viewing colors of a slightly different hue, which would appear of nearly the same hue when held in one position between two sets of lamps, and of a widely different hue when the colors were reversed so as to be lighted by the opposite set of lamps.

The relative rates of consumption of gas for a given candle power was next discussed, together with the heat produced and the contamination of the atmosphere by the products of combustion. The Welsbach was shown to save 70 per cent of the gas used by an ordinary flat flame burner for an equal amount of illumination. Acetylene gas was shown to be ten times as powerful an illuminant as ordinary water gas, or a burner using one cubic foot per hour would produce forty candle power.

The explosive properties of acetylene were discussed, and numerous instances were cited where acetylene compressed in tanks under a heavy pressure, so as to become a liquid, had exploded with fatal results. An instance was also cited where a machine generating acetylene at atmospheric pressure had exploded, killing two persons. In the case of the liquefied acetylene under a heavy pressure the explosion is similar to that of dynamite or ordinary gunpowder; that is, the elements will decompose without the presence of air. If the acetylene is not at a pressure greater than that of the atmosphere, however, such decomposition is impossible, and the acetylene must be mingled with air before there can be an explosion. Experiments were made in which acetylene and ordinary illuminating gas were exploded when mingled with air. The gas was allowed to escape from a burner into a partly confined space. The explosion produced by the acetylene was much more severe than that produced by the illuminating gas.

Calculations of the relative costs, in the city of New York, for equal illumination were presented. The incandescent electric light cost one cent per lamp of 16 candle power per hour. Ordinary illuminating gas at $1.25 per 1,000 cubic feet cost 0·5 cent, and the same burned in a Welsbach burner 0·17 cent. The cost of replacing the mantles of the Welsbach burners was included in the estimates. The difference of cost in favor of the Welsbach will disappear, to a great extent, in practice, for if ordinary gas burners are replaced by the Welsbach, the total amount of illumination, as a rule, becomes greater, and if three times as much, the cost of gas to the consumer per month would be the same with the Welsbach as it was with the ordinary gas burner. To compete with ordinary illuminating gas selling at $1.25 per 1,000 cubic feet in municipal distribution, calcium carbide, the commercial source of acetylene, would have to be sold to the gas company and converted into gas for $40 per ton to net the gas company the same profit, and to be as economical to the consumer as ordinary water gas burned in flat flame burners. To be as economical to the consumer as ordinary gas burned in Welsbach burners it would have to be furnished to the gas companies and converted into acetylene gas for $19.50 per ton. The ordinary mains now used for transmitting illuminating gas would not be suitable for acetylene on account of the leakage. If one-tenth the amount of acetylene were used, as with the ordinary gas, the percentage of leakage, based on the amount of gas used by the consumers, would be increased about ten-fold, or if the percentage of leakage in a system had been 5 per cent with ordinary gas, it would be about 50 per cent with acetylene of the gas used by the consumers, or 33 per cent of the gas stored in the holder.

It was further shown that to be as cheap as kerosene in domestic lighting the calcium carbide would have to be supplied to the consumer at $45 per ton, and the compressed liquid acetylene would have to be supplied at 6½ cents a pound.

It would not be profitable, as has been suggested in some literature on the subject, to convert electric lighting plants into plants for producing calcium carbide, the gas from which could be used for lighting, because the light given by the carbide so produced will be but one-half that obtainable by using the electricity directly in incandescent lamps.

The cost figures show that for an equal illumination the electric incandescent light costs twice as much as gas when the latter is burned in flat flame burners. The incandescent electric light has, however, held its own against the gaslight on account of its superior qualities, which are its brilliancy, cleanliness and adaptability. The electric light is also preferable on account of the fact that it does not vitiate the atmosphere with carbonic acid gas, and that it produces a less heating effect than ordinary illuminating gas. It also eliminates the danger of asphyxiation through an accidental leakage of gas. That the incandescent electric light has held its own at a higher cost to the consumer for a given candle power is a proof that other elements enter into the problem of artificial lighting as strongly as the cost of a given amount of light. From this standpoint it may be argued that acetylene, producing as it does a more brilliant light than any now used for interior lighting, and having the quality of showing the complexion in life-like tints, will have its own field, even should it be the most costly system of illumination.

Again, acetylene is now used in place of the calcium light for lantern projections, etc. Were it not for the explosive character of the compressed acetylene, it would be useful for cases of isolated lighting, such as for beacons and light buoys.

The figures of cost for equal illumination also show that the Welsbach lamp produces about three times the illumination for a given cost as ordinary illuminating gas burned in a flat flame burner. As has been already stated, however, the Welsbach lamp is deficient in showing the complexion in life-like tints. For most classes of work this defect is not of great enough importance to outweigh the advantage derived from its great economy.

The whole situation may be summed up by saying that each system of lighting has its own field of use fulness on account of properties peculiar to itself, which make it more desirable than the others for certain classes of work.

The lecture will appear in full in the next number of the Journal of the Franklin Institute.

* Abstract of lecture delivered at Franklin Institute, March 12, 1897.—From the Progressive Age.

Horseless Wagon in 1861.

It may be interesting to know that one of the earliest successful self-propelling carriages made in this country was owned and used in Newark in 1861 or 1862.

Mr. Joseph E. Ralph, of the Atlantic Highlands, remembers this carriage, and, in fact, during the years mentioned he says he was permitted to run it up and down Orchard street a number of times, although he was only a lad at the time. The carriage, says the New York Sun, belonged to the late Joseph Battin, well known as a hydraulic engineer. He built the waterworks in Elizabeth, N. J., and a large part of the stock of the water company there belonged to him when he died. He lived in Broad street and his property ran through to Orchard street. His stable faced Orchard street, and Mr. Ralph's family lived upon Orchard street, about a block away. Mr. Ralph says that at this time Mr. Battin had got rid of the horses which he had been accustomed to use and had replaced them with a carriage driven by steam. This was what might be called a light wagon, although it was of necessity much heavier than a light driving wagon. It had two seats, and the engineer, who always went out with the machine, occupied the rear seat. The front seat was for the owner, and he did the steering with a round hand wheel in front, something like the grip wheel on a Broadway cable car. The wheel had below it a cogwheel, and this engaged with a toothed half circle segment that was bolted to the fifth wheel of the front axle.

Mr. Ralph says he remembers the steering gear very well, because it took several turns of the steering wheel to bring the wheels around enough to turn a sharp corner, and it required lively work to get the wheels back again in line quickly enough to straighten the course of the carriage before it ran up on the sidewalk. This peculiarity was apt to make a new hand at steering the carriage lose his head.

On the other hand, he remembers very little of the driving engine and gear. The engineer attended to these, and it was through a boyish acquaintance with the engineer that he was permitted at times to mount the driving seat and steer. That Mr. Battin got a great deal of service out of the carriage Mr. Ralph is certain. Mr. Battin went out in it often, and frequently stayed away with it for several days. At these times it was understood by the neighbors that he was engaged up in the hills or about Elizabeth in superintending work on the waterworks or dams that he was building. If this was true and the wagon was capable of traveling over the sticky roads which that country had in bad weather in those days, the carriage must have been unusually strong and useful.

Carbons for Electrolysis.

The extension of electrolytic processes in industrial chemistry has created a demand for terminals which shall be inexpensive and permanent, and numerous patents in this line have been taken out, especially in connection with the electrolytic production of the alkaline chlorides.

Gas carbon is not available in large sheets, such as are commercially required, and hence these have been made of powdered coke, baked with a cementing material in the same manner as electric light carbons are made. Such carbon plates, however, are not permanent, but soon become disintegrated by the action of the solutions, and especially by the action of the liberated gases.

Dr. Alber Lessing, in the Elektrochemische Zeitschrift, claims to have solved the problem by producing carbon sheets entirely homogeneous and free from cracks, by a fusing process which not only insures the permanence of the sheet, but also increases its conductivity. The new product is said to be harder than steel, readily scratching glass, and proof against the emery wheel, and possesses a metallic ring which testifies to its homogeneity. If these claims are maintained, and the prepared carbon can be produced at a reasonable price, it should soon be on the market for many other uses as well as the one for which it was originally produced.

American Brooms.

American brooms are exported in large numbers to many countries, says the New York Sun. Our exportations of brooms to some countries have within recent years, owing to natural causes, decreased; but our aggregate exports are nevertheless now larger than ever and still increasing. We send brooms to Central America, South America, and South Africa, to the United Kingdom, and to France and Germany. We sent many brooms to Australia; now we send few brooms there, but we send large quantities of broom corn, and we send there, too, broom-making machinery. American broom-making machinery is sent also to other foreign countries. At one time many American brooms were sold in the Argentine Republic, but now they are raising broom corn on the Plate River, and making brooms down there too. We send now and then a little lot of brooms to China, but we send none or practically none to other Asiatic countries, and our exports to China are so small as to be of no consideration whatever in the account.

The climate of this country is favorable to the growth of broom corn, and here broom corn is cultivated with the greatest skill and with the best results. Considerable quantities of broom corn are raised in Italy, but it is of a poorer quality and it is commonly permitted to ripen too much, until it is red, and lifeless and brittle. The Italian corn is made into brooms in Germany, where the labor is much cheaper than here; but that cheapness is offset by the effective use of machinery here. In this country even the corn itself is harvested and sorted by machines. American brooms of the lower grades are put down in Germany at prices that are very close to those of the poorer German brooms. The higher grades of American brooms cost more, but they are the best brooms in the world. They excel in durability and in all other good qualities. Some brooms are packed for export in boxes; but there are countries in which import duties are levied on gross weight, where a packing box would be too costly a tare; and brooms for export are commonly packed in burlaps, handles and all being completely covered.

We send no whisk brooms to Europe; there they still cling to the old-fashioned clothes brush. But to all other countries to which we send brooms we send whisk brooms, too.

The Victoria Bridge at Montreal.

The active work of enlarging the Victoria Bridge at Montreal will be begun within the next month and will be completed in eleven or twelve months. It is expected that more than one and a half millions of dollars will be spent on the work and employment given to hundreds of men. The work of reconstruction will be done without interfering in any way with the operation of trains over the bridge. The contract for the reconstruction of the bridge has been let jointly to the Dominion Bridge Company, of Montreal, which contracted for the full capacity of its works, and the Detroit Iron and Bridge Company, which takes the remainder of the work. The bridge when completed will be an open truss steel structure with double steel tracks and facilities for foot passengers, vehicles and electric railways.

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THE THIRD RAIL SYSTEM ON THE NEW HAVEN RAILROAD.

The third rail system of electric traction is now in permanent operation on an important section of a leading steam railroad. The recent opening of the line from Berlin to New Britain and from New Britain to Hartford, while it is by no means the first successful operation of third rail traction, is notable as being its first application in a permanent way to the lines of a standard steam railroad.

The first extensive test of this system took place within the grounds of the World's Fair, at Chicago, where its operation was very satisfactory. It was then adopted on the elevated roads of Chicago, where it has given reliable service. The Brooklyn Bridge trustees decided that it was adapted to the requirements of bridge traffic, and laid a third rail on the outside of the tracks. The equipment has given a good account of itself, especially in the switching operations at the terminal stations.

It is stated by Col. N. H. Heft, chief of the electrical department of the New York, New Haven & Hartford Railroad, who has afforded us every facility in the preparation of the present article, that the probability of electricity entering largely into the operation of steam railroads was suggested to the directors by Mr. Clark in his annual presidential report made in 1891. It was natural that the attention of this company should be turned to the question of electric traction, for the reason that their passenger traffic was being exposed to severe competition from the network of suburban and interurban trolley lines which have sprung up throughout the country served by the New Haven road. Fully one-half of the gross receipts of this road is realized from passenger traffic, and a large proportion of this is obtained from local traffic, of a character for which suburban trolley car service has most attraction.

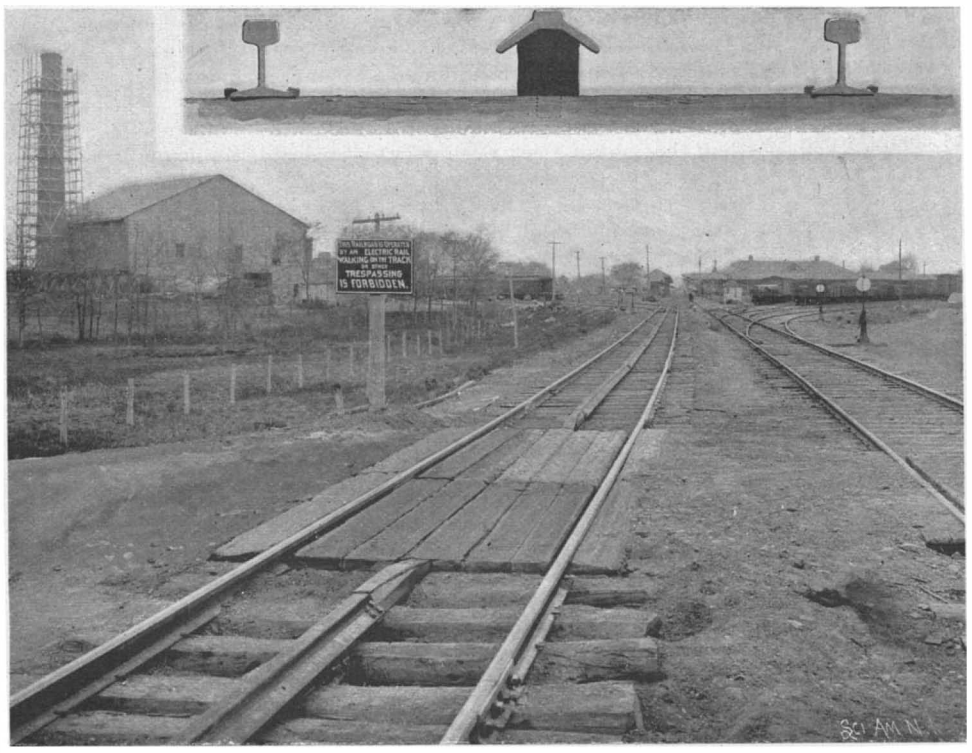
The first step taken by the company was to form an electrical department, and give orders for the electrical equipment of a stretch of their road which runs from Nantasket Junction to Pemberton, Mass. This equipment, which is commonly known as the Nantasket Beach line, was put in operation in 1895. Overhead conductors were used and the experiment was highly successful. The company then determined to test the third rail system of transmission, and a trial line was laid down in 1896, when an additional 3½ miles of road was placed in service. The operations at Nantasket were regarded by the company as being experimental and preparatory to a further extension of the system. The results were so promising that it was determined to apply the system on a larger and more permanent scale, embodying in the new line the results of previous experiments.

The equipment which has recently been put in operation is applied to two lines of steam railroad, one extending from New Britain to Berlin and the other from Hartford to New Britain, the total length of the line from Hartford to Berlin being 12·3 miles.

The power station has been built with a view to its enlargement as the electric equipment is extended. The building shown in the accompanying engraving is 106 feet wide by 117 feet in length, the end on which the extension will be added being temporarily walled in with wood planking. The present building contains two stories in the front devoted to the engine and generators, etc., and a boiler room in the rear extending the full height of the building. A 1,200 horse power engine is already in place and the foundations have been built for a second. There is room in the building for a third engine when the extension of the line calls for it. Further details regarding the engines and the boilers will be given in a later issue. The engine is direct connected to a General Electric Company's standard 10 pole, 850 kilowatt generator of the well known ironclad type, which furnishes current at 600 volts no load and 650 volts full load.

The third rail conductor is of a special section rolled for this purpose. It resembles somewhat a flattened Λ, the flanges forming a protection to the insulating blocks upon which it is laid. The rail is heavy, weighing ninety-three pounds to the yard, and it is found that wooden blocks saturated with insulating material give excellent service, and three to the rail are found to be sufficient. The flanges of the rail come within 1½ to 1⅝ inches of the top of the ties, the head of the rail being one inch higher than the main rails. It will be seen that this conductor is carried much lower than that on the Nantasket line, the difference being due to the height of the main rails. The ends of the rail are bonded by sheet copper plates ⅛ inch thick, 4½ inches wide and 12 inches long, which are held against the under side of the flanges at the rail ends by iron plates. The latter are bolted to each rail by sixteen bolts, eight for each plate, the copper bonds being sandwiched between the iron plates and the rail. The capacity of each bond is 900,000 circular mils, the double bond having more than the carrying capacity of the rail itself.

On the whole line there are twenty-two grade crossings, at each of which the third rail is replaced by underground cables of 850,000 circular mils. The cables are drawn into creosoted wooden conduits filled with an insulating material made of residuum and asphalt. The conduits are laid in creosoted wooden troughs filled with the same material, which are buried in the earth. Special attention has been paid to the return circuit, as it is the opinion of Col. Heft that the importance of this element is too often overlooked in the construction of electric roads. The company has put in leaf bonds of 550,000 circular mils, and these are attached to the base of the rail in preference to the web, and are secured by wedge fastenings. In order to prevent any interruption to the current when a train is passing over switches and crossings a shoe is provided on the rear car of a two-car train. This insures that connection will be made by the shoe of the motor car before the shoe of the second car has entered the gap.

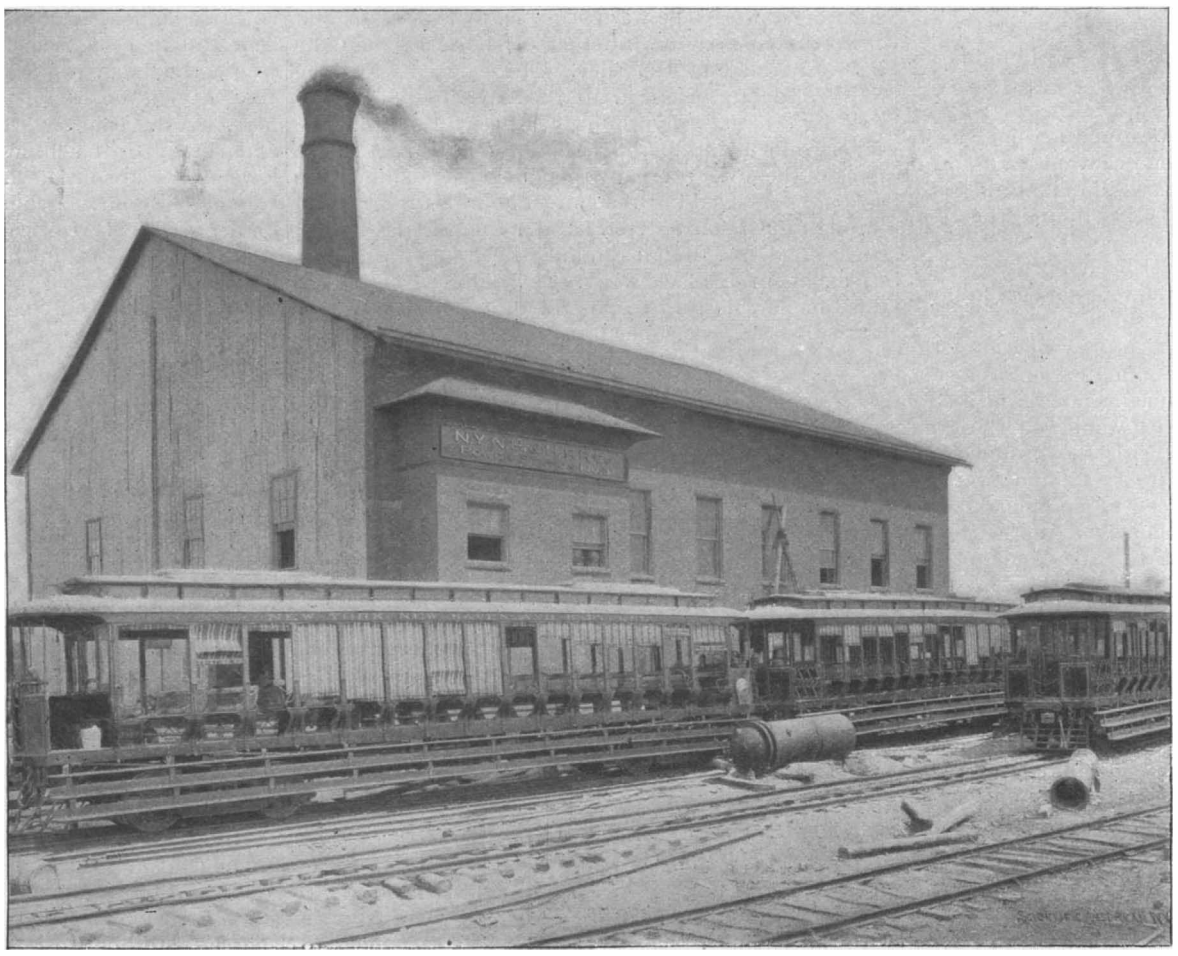


THE N. Y., N. H. AND H. RAILROAD THIRD RAIL EQUIPMENT—VIEW OF ROAD CROSSING AND CROSS SECTION OF TRACK.

The general appearance and mechanical details of the open cars are shown very clearly in our front page and other illustrations. They are 51 feet long, and are provided with sixteen seats, each of which can accommodate six passengers, the capacity of a two-car train being, therefore, 192 passengers. The current is taken from the third rail by means of a sliding contact shoe, which consists of a simple cast iron plate 5 inches wide by 12 inches long, weighing about 12 pounds. It is carried by an insulated support, to which it is fastened by jointed links, which allow it to bear upon the rail at all times with a pressure due to its own weight. Each train is made up of a motor car and a trailer. Each motor car has two 125 horse power motors, both of which are mounted upon one track, as shown in the accompanying engraving, in which the casing has been removed to show the gearing of the forward motor.

It can well be understood that in a service of this kind, where the high speeds which are customary in the steam service are to be regularly made, special attention had to be given to the question of braking. As hand-operated brakes were out of the question and steam was not available, it was determined to equip the motor cars with a separate electrically driven air brake plant. The details of this successful and highly creditable work are shown in the upper front page engraving, and its position on the front platform is shown in the side view of the car.

The two cylinder, single acting compressor is driven by a direct connected 10 horse power motor. The compressor has a capacity of 52½ cubic feet of air per minute under a gage pressure of 90 pounds per square inch. The speed is 250 revolutions per minute and the consumption 16 amperes at 600 volts. The standard Westinghouse air brake equipment of the company is used on the cars, and it is controlled by the usual engineer's valve, as shown in the engraving. One of the most ingenious features is the automatic valve and switch for starting and stopping the compressor, of which a sectional view will be found on the front page. By reference to the engraving it will be seen that air is led in above a small piston, which works in a vertical cylinder and is pressed upward by a coil spring. The spring is set at the working pressure of 90 pounds to the square inch. As soon as the air pressure exceeds 90 pounds, the piston is forced down, carrying with it a small vertical valve stem and allowing the air to pass up into a small cylinder located beneath the electrical switch which controls the motor of the air compressors. Here it pushes up a piston which throws over the electrical contacts and opens the switch. As the air pressure falls it releases the lower piston, which rises to its normal position. As it rises, a catch on the piston rod lifts the small lever shown



THE POWER HOUSE AT BERLIN.

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to the left and opens a release valve below the switch cylinder above mentioned. The upper piston now falls and closes the switch, thereby starting the motor of the air compressor. The device has given complete satisfaction. It may be set to work at from 45 to 100 pounds pressure, and on a variation of from 5 to 7 pounds pressure.

The air compressor is placed, as shown, on the front platform of the car to the left of the motorman. In front of the compressor is the wheel of the hand brake, and conveniently arranged in front of the motorman are the pressure gage, the engineer's air valve and the controller. The lever for operating the air chime whistle passes through the hood just above the motorman's head. Beneath the hood on the front of the car above the door are the current breaker and the main switch. On the front rail of the platform there is also a conductor's signal whistle.

The current passes from the shoes through flexible copper cables to the circuit breakers. After passing through these it is led through a lightning arrester and a "kicking coil." It then divides, passing to the controllers on each platform. At each controller it passes through a magnetic blow-out coil, and is led by cable to the resistance situated in the center of the car. It then returns through the resistance contacts to the controller cylinder and the motors.

The danger to the public from the use of the third rail is considerably less than is popularly supposed, and in view of the precautions which have been taken to safeguard the ignorant or unwary, the chance of accident is very small. At the Berlin and Hartford stations the third rail section is fenced in on both sides. At New Britain, where the two lines converge, a switchman's tower has been built in the Y where the roads converge. Underground cables connect the rail where it enters the station with a switchboard in the tower. When a train has stopped in the station the third rail is cut out, and it is not thrown in until the train is ready to start again.

When the road which has now been electrically equipped was operated by steam, eight trains a day were run each way between Hartford and New Britain, and fourteen trains a day between New Britain and Berlin. Under the present system two-car trains will be run every half hour between Hartford and New Britain from six in the morning till twelve at night. The run of 9·3 miles will be made in something under twenty minutes, and the fare will be ten cents each way. Sixteen trains a day will be run between New Britain and Berlin, a distance of three miles, the fare being five cents for a single trip.

We reserve further particulars and illustrations of this interesting plant for a later issue.

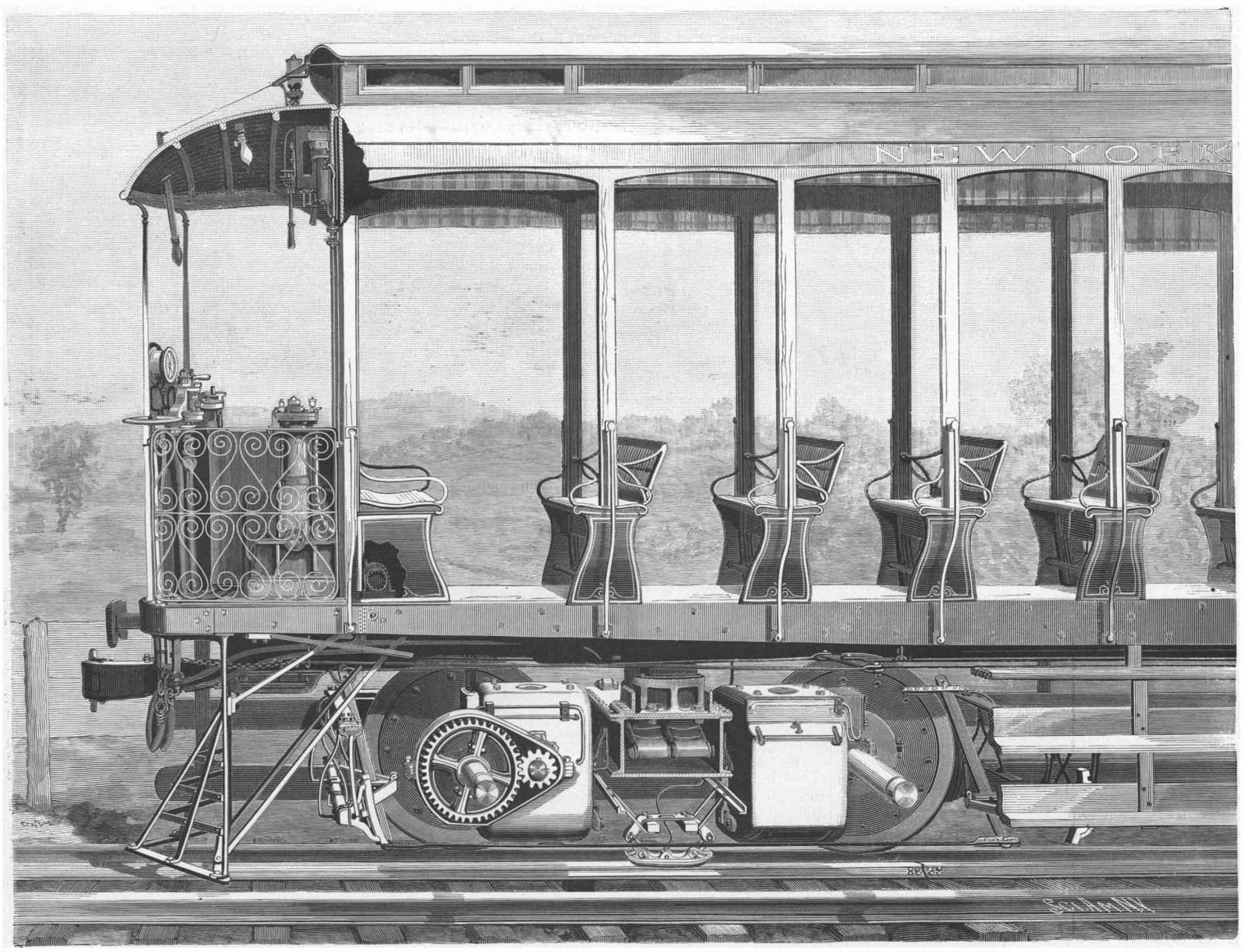
How to Make an Actinometer.

Make, in any way you like, some apparatus by which you can make a strip of sensitized paper pass behind a narrow slit in some opaque material. An old watch case can easily be made to do this with a little fixing up. Then place a circular piece of any P. O. P. in the watch case, so that on turning the handle, or by other means, according to the way you have made it, fresh portions of the paper are brought before the slit, till the whole piece is used up. Then you have to find the correct exposure, with a certain stop, and a certain bromide paper. This you can easily do by making trials on small strips of the bromide paper. While you are exposing the paper for the correct time, hold the watch case with a fresh piece of P. O. P. under the slit in the light for the same time as you expose the bromide paper. Then take the watch case and paint by the side of the slit, or on each side of it, with water or oil colors, a color to match the tint of the paper. All you have then to do, when you wish to make an enlargement, is to expose it for the same time as the P.O. P. takes to go to the match tint and you will have it correctly exposed. This simple piece of apparatus does away with the difficulty of judging the light for enlarging. With a little adaptation, it can also be used for an actinometer for ordinary outdoor photography. For you can find the correct exposure with a certain stop, and the plate you usually use matching the tint on the paper as before or else using the same tint as you used for enlarging, and suiting the stop to the exposure. Most plates of the same brand are often compared in speed by their makers (as for instance the Ilford), and so you can tell the exposure necessary for any of the same make. If you do not use plates of the same maker, you can buy at almost any large dealer's a small list giving the comparative speeds of all the well known dry plates in the market. For using the actinometer you have to hold it in the shade if you are taking a landscape, or, indeed, almost every kind of subject, for clouds are the only subjects the exposure for which you may find by holding the paper in the direct sunlight.—Photographic News.

Costliest of Fish Hooks.

The most costly of fish hooks are those for tarpon. They are sold at retail at various prices from $1 a dozen for bare hooks up to $7 a dozen for hooks fitted up. The standard tarpon hook is four inches in length. Some tarpon fishermen prefer to mount their own hooks. They have ideas of their own as to the best way and the best materials. A swivel is always used. Some of the hooks that are sold fitted up have snells of German silver chain. Sometimes laces of rawhide or porpoise skin are used for snells. Some hooks are fitted with snells of piano wire two feet long, made in three lengths of eight inches each, linked, to prevent kinking. Fitted up tarpon hooks that are sold at $7 a dozen are provided with thirty-six inch braided or plaited linen snells, wound for two-thirds of their length, from the upper end downward, with copper wire. The tarpon swallows the hook and its teeth are brought up on the snell, where it is protected by the copper wire. Sometimes a shark takes the bait. It is desired to lose the shark without the trouble of hauling it in and casting it off, and the shark is likely to free itself by biting through the unprotected lower third of the snell.

While the tarpon hook is the costliest of hooks, there are flies that sell for more. There are some salmon flies that retail as high as $9 a dozen.—New York Sun.



THIRD RAIL SYSTEM ON THE N. Y. N. H. & H. RAILROAD—FRONT END OF MOTOR CAR.

In view of the anticipated exhaustion of the quarries of lithographic stone at Solenhofen, Bavaria, the use of aluminum as a substitute in engraving has been suggested, and the German journal Neueste Erfindungen und Erfahrungen enumerates the qualities that may render that metal suitable for the purpose. The National Druggist, of St. Louis, points out, however, that there are lithographic quarries in Tennessee which can furnish immense quanties of stone fully equal, for all the purposes of engraving, to the very best Solenhofen.

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Science Notes.

M. Levassor, who was widely known in connection with the horseless carriage movement, died recently, at the age of 54. He drove the winning vehicle from Paris to Bordeaux and back in the famous race.

There is certainly something odd about the element cerium, says the Progressive Age. M. Schutzenberger, a well-known French chemist, has shown the Academie des Sciences that monazite sand yields three different ceriums, agreeing in spectroscopic character and in the ordinary reactions of cerium, but not in all chemical respects, and having the respective atomic weights of 138, 148 and 157.

The buildings of the New York Botanical Garden, with approaches and surroundings, cover twenty-five acres. The pines and other coniferous trees will occupy thirty acres; seventy acres will be devoted to deciduous trees; twenty-five acres will be left as a natural forest; shrubs and small trees will occupy fifteen acres; eight acres will be devoted to herbaceous ground for scientific arrangement; the bog garden will occupy five acres; lakes and ponds six acres; and meadows ten acres. The museum building will have a frontage of 304 feet, with two wings, each 200 feet in length.

Mr. Oliver C. Farrington writes to Science, sending a reproduction of a school geography's picture of Popocatepetl, and by the side of it an outline of the actual mountain. The difference is quite startling. The slope of Popocatepetl was found by Mr. Farrington to be never more than 30 degrees, while the picture represents a snow-capped peak with a slope of from 40 to 50 degrees. "A tall cross, such as no traveler in Mexico ever saw, and luxuriant palms, such as never grow at the altitude from which Popocatepetl can be seen," furnish a fitting foreground for a picture so unfaithful to the literal facts of the region.

A fur seal has none of the altruistic instincts of some other animals, for she will never feed any pup but her own, says the Popular Science Monthly. Not a very affectionate mother at best, she yet unerringly knows her nurseling's voice, and he in turn learns to find her. When they meet and recognize each other at meal time, it is easy to see that they belong together. Her duty done, however, she lets it shift for itself till the next feeding time. She instantly knows any little hungry intruder that is stealing up to her to get a meal on the sly. She cuffs and bites, until the starveling, intimidated, slinks away to die. These orphaned younglings are the fruit of the indiscriminate "pelagic" sealing. Their mothers being killed, and they unable to obtain another nurse, they perish by the thousands. A United States report estimates the number for 1896 at 20,331.

Considerable misconception prevails as to the manner in which the ostrich runs, says the Zoologist. It seems to be still generally held that when running it spreads out its wings, and, aided by them, skims lightly over the ground. This is not correct. When a bird really settles itself to run, it holds its head lower than usual, and a little forward, with a deep loop in the neck. The neck vibrates sinuously, but the head remains steady, thus enabling the bird, even at top speed, to look around with unshaken glance in any direction. The wings lie along the sides about on a level with, or a little higher than, the back, and are held loosely just free of the plunging "thigh." There is no attempt to hold them extended or to derive any assistance from them as organs of flight. When an ostrich, after a long run, is very tired, its wings sometimes droop; this is due to exhaustion; they are never, by a running bird exerting itself to the utmost, held out away from the sides to lighten its weight or to increase its pace. But the wings appear to be of great service in turning, enabling the bird to double abruptly even when going at top speed.

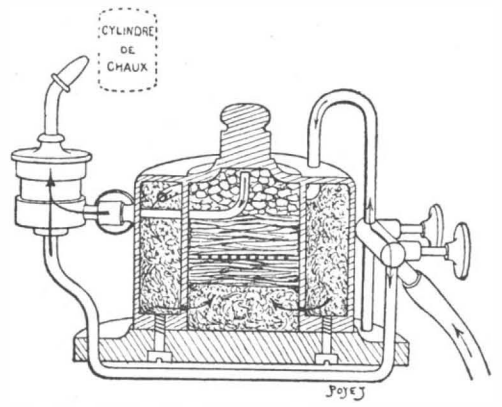
According to the Bulletin of the Belgian Astronomical Society, says the Literary Digest, recent experiments in Styria on the breaking up of hail storms by the firing of guns have met with remarkable success. "M. A. Stiger, burgomaster of the city of Windisch-Feistritz, and proprietor of extensive vineyards, having replanted a part of his land on the Schmitzberg, took the following precautions to preserve the young plants from hail storms, to which this region is exposed. Over an extent of about six kilometers (3·7 miles), at elevated points, he built six iron structures, each holding ten large mortars; at some distance from each of the structures he located a hut to be used as a powder magazine. M. Stiger then organized a body of volunteers composed of the inhabitants of the neighborhood, so that each post could in case of necessity be manned by six persons. In the course of last summer the residents of Windisch-Feistritz were able to make their first experiment. Masses of black and threatening clouds approached from the neighboring mountains. At a given signal the discharge of the sixty mortars began. After some minutes the clouds could be seen to pause, break up and disperse without letting down either hail or rain on the protected region. The experiment was repeated in the course of the same summer, taking place six times and always with the same success. The efficacy of the discharge extended over about one square mile."

THE PROBABLE CAUSE OF THE GREAT PARIS FIRE.

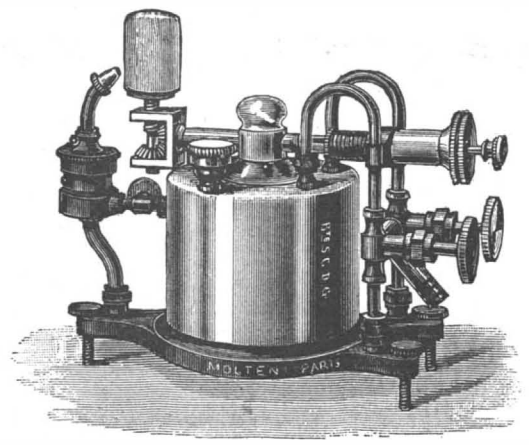
If the most contradictory, most fantastic and uselessly complicated theories have been conceived regarding the way in which the fire of the charity bazar at Paris could have arisen in the cinematograph room, it is surely because the action of the lamp which was used to project the images on the screen was not sufficiently considered.

The management of the cinematographic performances of the charity bazar had at its disposal neither electric light nor a gas supply for the oxyhydrogen flame. They had then to resort to a Molteni lamp, whose flame can be fed indifferently, either with ether or with gasoline. Our cuts represent the aspect of the externally visible parts of the lamp, and also a vertical section.

Such a lamp consists first of a cylindrical bronze box, ten centimeters in diameter, filled with some absorbent, such as pieces of pumice stone or felt, intended to store and keep the liquid used. Since the apparatus is completely stuffed with such material, no space in the interior can, by permitting the collection of free liquid, form a reservoir for explosion in case the flame should beat back. This is simply the principle of the Pigeon lamp, and of all lamps for home use with mineral fuel. The only difference lies in the method of bringing the combustible fluid to the jet where the flame is to burn. In the Molteni lamp, instead of a wick acting by capillary attraction, we have a stream of oxygen, provided from a cylinder which supplies it under the required pressure. The oxygen passes



VERTICAL SECTION OF THE MOLTENI LAMP.



THE MOLTENI LAMP FOR ETHER AND OXYGEN.

through the box, which, for saturating purposes, is divided into two concentric compartments, circulates through the absorbent, saturated with gasoline or ether, and, charged with inflammable vapor, escapes by a blowpipe. After passing through the saturator at the top, as shown by the curved pipe in the upper illustration, the enriched gas is mixed again with a second stream of pure oxygen coming directly from the cylinder, and shown in the lower pipe under the saturator, which, when ignited at the end of the blowpipe nozzle, produces a blue flame of intense heat. The flame, impinging upon the lime cylinder, heats it to incandescence at a temperature of 2,000° Centigrade, producing an intense light, equal to the well known oxyhydrogen lime light.

In using a lamp designed to burn the lighter mineral oils, greater precautions are required than those for ordinary kerosene oil.

The method of filling the Molteni lamp is to unscrew the stopper on the top, and slowly pour in 150 cubic centimeters of the liquid chosen. The lamp is then left to stand for some time, so that the absorption of the liquid may be as complete as possible. The lamp is then turned over, so that any liquid not absorbed, but freely running in the reservoir, may drain off to the last drop.

Should too much liquid be put in, when filling, there is a risk of its running over into the tubing of the lamp. Before filling there might be also some liquid left over. Finally, before lighting, it is necessary to let the oxygen pass freely for a while to dry the pipes, which might have kept some moisture.

The oxygen ether lamp—ether was used at the bazar—gives light for an hour and a half. Perhaps the one that caused the catastrophe on the 4th of May had worked beyond that time. The operators moved in a restricted space, they were unused to the locality, and hindered in their movement. Which of the precautions mentioned above did they omit? What accident, as commonplace as that which may happen in our kitchen any night, fell upon them? It is difficult to tell. Possibly as the ether in the saturator was used up faster than was expected, and as the light became weaker in consequence, the operators determined to shut off the oxygen and recharge the saturator with a fresh supply of ether.

Bearing in mind that the lime was still hot and had not been removed from its place and was quite near to the filling aperture, a drop of the ether might have spattered unnoticed on the lime and ignited.

Whether such was the case can never be known. Certain it is that those who knowingly allowed the storage of even a small amount of such an inflammable fluid as ether in such a place are open to censure.

On the other hand, the people who had raised those cardboard decorations, those hangings of light stuff, and those casements of varnished wood had not foreseen the placing there of the ether lamp. It is difficult indeed to learn just who was responsible for the catastrophe.—L'Illustration.

The Effect of Removing the Ends of a Magnet.

It is well known that when a magnet is cut so as to divide it into two parts, two complete magnets are formed, whose poles are arranged in the same way as in the large magnet before cutting. It has occurred to J. F. Smith to ascertain the effect of cutting from the ends of a wide thin magnet strips whose width is small compared with their length. His experiments are described in a recent issue of the Western Electrician, and are illustrated by diagrams showing the effect of removing the ends of the magnet in various ways. These experiments seem to indicate that when a wide thin magnet is cut or broken so that the part removed has a length greater than its width, the arrangement of the poles is different from that ordinarily obtained by cutting the magnet. On a consideration of the nature of the behavior of Faraday's lines of force, the explanation seems to be as follows: At the regions where the lines of force enter or leave the magnet the poles are located. Each line of force is a closed circuit running from pole to pole through the magnet, and making the return circuit through the air. When the magnetized strip of steel has got almost across, the lines of force are diverted from their usual path through the magnet, and are crowded together, the narrow portion joining the small strip at the end to the larger magnet. Since the strip furnishes a better path for the lines of force than the air in the gap where the metal is cut, the lines are thus shifted, so that they run lengthwise of the strip instead of crosswise. The lines of force then leave the strip at the ends or near the ends. When the small strip is being broken from the main strip, the lines of force leap across from the larger strip to that point of the small strip which is nearest the large one, and thus the formation of a separate pole begins. When they are completely separated, this lost point, at which the strips were joined, becomes a separate induced pole, permanent and of opposite kind to the adjacent pole of the larger magnet. Essentially the same thing takes place when the strip is cut from the sides toward the middle, the results being the formation of a north seeking pole at each end, while the consequent south seeking pole is induced at the middle, where the lines of force leap across from the larger magnet.

Is there any "Best" Time for Sleeping?

Does the time at which the sleep is obtained, provided it is sufficient in amount, make any change in the result? In brief, is there any truth in the old adage that an hour before midnight is worth two hours after midnight? I had an opportunity to make some study of this subject in my naval service during the late war. On shipboard, as is undoubtedly known to most of you, the ship's company—officers and men alike—stand four-hour watches day and night, and to get the required amount of rest are obliged to get their sleep irregularly; to so arrange it that the same man shall not be obliged to take early or late watches continuously, the "dog watch" of two hours is interpolated, thus adding to the irregularity. In watching the results for over two years I could never discover that the watch officers and the men were not as fully refreshed by their sleep as were the medical and pay officers, who stand no watch, and have hours as regular as those of any householder.—Dr. E. P. Colby, in the New England Medical Gazette.

IN 1896 there were imported into Germany 591,500 kilos of crude aluminum. Of these, 467,600 came from Switzerland, 55,000 from France, and 8,400 from Austria. In the first two months of the current year 138,900 kilos were imported, as against 65,900 for the corresponding month of the previous year. The importation of sheet aluminum also is rising, and the customs duties on the metal on the Swiss frontier have consequently been lowered.—Stahl und Eisen.

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THE BATTLE AT MILOUNA—A TURKISH ENGRAVING.

We reproduce a Turkish print representing the battle at Milouna. This primitive etching is an additional proof that art in its infancy is alike everywhere.

The Turkish artist—or perhaps the Greek artist, for the practice of Oriental art has ever been in the hands of the Greek—full of Occidental traditions in the maker of military painting, has given his special attention to the general's staff, which he has grouped around the victorious leader, Edhem Pasha, whose likeness is caught with a vengeance.

The officers watch the fighting of men so small that we might imagine the combat before us is taking place between two armies of tin soldiers. The box from which they are taken is of the latest model, for it contains all the accessories for the battle. We even find among these a division of ambulance, which would certainly be to our surprise, were it not that we hear, through the newspaper correspondents, that this war is conducted by the Turks with an extraordinary degree of culture and lenitude.

The French journal L'Illustration has just published this etching, and from that source we have taken our copy.

Newfoundland's New Industry.

Newfoundland is about to follow the example of Norway in making the humpbacks and fin whales, which are said at the present time to be found in immense numbers round the coast, the objects of systematic pursuit, says the London Standard. For this purpose a company has been formed at St. John's, and the superintendent of fisheries has organized a fleet of small steamers, with harpoons and bomb firers, such as are used in Norway, to carry on the fishery. There is, perhaps, something misleading about the use of the term "fishery," for it seems to imply that whales are fishes. Of course, every one knows that this is not the case, but that whales are as truly mammals as are oxen and pigs; and are probably descended from hoofed animals which, ages ago, took to aquatic life, first in fresh water and afterward in the open sea. The fishlike form of these gigantic creatures is entirely due to the conditions under which they live, and is in no sense indicative of relationship.

Whales fall naturally into two great groups—those with teeth and those which possess none, but have the upper jaws fringed with baleen, the whalebone of commerce. To the first group belong the sperm whale (Physeter macrocephalus)—from which are obtained spermaceti, ambergris, and sperm oil—and the dolphins; to the second, the Greenland or right whale (Balæna mysticetus), the humpback (Megaptera boops), and the finners or rorquals (of the genus Balænoptera). The whales of this second group live on small marine animals. In feeding, a great gulp of water, containing an immense number of these tiny creatures, is taken in and the mouth closed. The whalebone allows the water to run off and retains the prey to be swallowed.

The great object of the northern whale fishery in both hemispheres was the right whale, and the pursuit was at one time highly remunerative. In the early part of this century the British whaling fleet consisted of over 150 ships, of which London furnished about a half, while Bristol and Whitby sent a considerable number. Now Dundee and Peterhead are the only whaling ports, and the total number of ships is probably under a dozen. Indeed, owing to the scarcity of right whales in northern waters, a fleet of four whalers was sent in 1892 from Dundee to the Antarctic in search of these animals, which Sir James Ross reported as occurring in abundance in that region. About the same time the Jason—in which Nansen made his first voyage to the Arctic regions—was dispatched from Norway on a similar errand, and other Norwegian whalers have since visited the same seas. The result has been extremely disappointing.

A naturalist who sailed in one of the Dundee whalers says: "Whales were the objects of our voyage, and we saw many, but none that were worth the catching;" and he adds that none of the vessels found any signs of a whale in the least resembling the Greenland species, although they were in the ice for a period extending over two months. It is, of course, impossible to say whether Ross was mistaken. His statements are definite enough, and he also speaks of the sea being full of the small crustaceans and mollusks which form the food of the right whale. But neither right whales nor their characteristic food gladdened the eyes of Scotch or Norwegian whalers, though fin whales and their characteristic food were met with in plenty.

The whales now abounding on the coast of Newfoundland probably belong to five distinct species, contained in two genera. These range over the North Atlantic and are found in nearly all seas, and there is no doubt that specimens of all the forms have, at one time or another, been met with on our own shores. The humpback (Magaptera boops) is so called by whalers from the low, humplike form of the dorsal fin, which varies greatly in shape and size in different individuals, and is generally spoken of as "the hump." The skin underneath the throat is gathered into folds and ridges, as it is also in the finbacks; the pectoral limbs, or "fins," corresponding to the human arms and to the forelegs of an ox or horse, are disproportionately long. It has been characterized as "decidedly ugly," and it is certainly far from being so symmetrical in form as most of the finbacks. The usual length is said to be from forty to fifty feet, but Scammon records one which yielded seventy-one barrels of oil, and was "adjudged to be seventy-five feet in length." Estimated lengths are extremely untrustworthy, and fifty-two feet is the greatest measurement the same author gives for a humpback over which the tape had been passed. He puts the yield of whalebone as averaging four pounds to every barrel of oil, so that this whale should have yielded just two hundredweight and a half. Of the finbacks, or rorquals, there are probably four species—the common finback (Balænoptera musculus), the sulphur bottom (B. Sibbaldi), the blue whale of the Norwegians, Rudolphi's whale (B. borealis), and the lesser fin whale (B. rostrata). All these yield whalebone and blubber, though not in such quantity or of such good quality as those of the right whale. For this reason, and also on account of their great activity and the difficulty of capturing them by hand harpooning, they were formerly neglected by whalers; but since the employment of steam vessels, with bomb guns and explosive lances, a fishery has been established on the Norway coast, with a factory at Hammerfest, for the utilization of the products.

The work carried on there consists chiefly of drying the whalebone and preparing it for the market, and rendering down the blubber into train oil. The flesh of Rudolphi's whale is there preserved on a large scale for human consumption. Mr. Collett says that the flesh of no other finback whale is considered fit for such a purpose. If, however, the whalers of Newfoundland should, as is probable, take many specimens of the lesser fin whale, it might be worth while to try the experiment of preparing its flesh for the market. There can be no doubt that it is wholesome and nourishing, and excellent evidence exists that it is also toothsome, so that if the prejudice against its use could be overcome, there is no reason why "whale steak," preserved and put up in tins, should not find ready sale.

THE BATTLE AT MILOUNA, ACCORDING TO A TURKISH ENGRAVING

In 1829 a specimen of this whale was entangled among the rocks at Runton, in Norfolk, and killed by the fishermen. Miss Gurney recorded in her diary the fact that the creature was 24 feet long, and that its jaws were lined with white whalebone. "A steak cut from it tasted, when cooked, like tender beef." The porpoise—which is a toothed whale—was formerly held in high esteem for food in England and in France, and in the days of Henry VIII and Elizabeth was considered a royal dish.

In the Revue Scientifique M. P. Privat-Deschanel discusses the question of the possibility of the reforestation of the Sahara, of which certain travelers, especially M. Largeau, have entertained such sanguine views. While dismissing as Utopian all ideas of effecting a change on a large scale, such as would alter the general atmospheric conditions and admit of cultivation everywhere, M. Deschanel points to the success of certain local experiments at El Golea and elsewhere, which prove that in valleys favored with a small amount of water (such as is found in almost all the Saharan depressions), such trees as the tamarisk, acacia, eucalyptus and poplar can be grown with success. Contrary to what might have been expected, the poplar proves to be the tree most capable of resisting the influence of the desert. Under the shelter of the trees all kinds of vegetables and fruit trees can be grown. M. Deschanel urges that such local attempts to improve the desert should be persevered in, but that the arid plateaus should be definitely abandoned as hopeless.

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RECENTLY PATENTED INVENTIONS.

Engineering.

DRAINING ENGINE CYLINDERS.—Clayton A. Dunham, Clarinda, Iowa. An automatic drain for relieving steam engine cylinders of water of condensation, without permitting much escape of steam, is shown by this patent. A pipe is connected at its ends with the ends of the steam cylinder, there being connected with the pipe a piston valve discharging into a drain cup, and the latter having an expansion plug normally open for the escape of water of condensation, and adapted to close by the action of steam. The device also gives immediate escape for an excessive amount of water, should it enter the cylinder from any cause besides mere condensation. The drain is applicable to all classes of reciprocating engines, and is designed to be of great service on elevator pumps and electric light engines, and readily applicable to marine or locomotive engines.

Railway Appliances.

CAR SHIFTING DEVICE.—Thomas C. Anderson, Tarentum, Pa. This is an improvement more especially designed for use in railroad yards, to facilitate making up trains without the use of turntables and the numerous side tracks and switches now employed. A bridge pivoted at one end is mounted to swing horizontally, the bridge having a track connected at the fulcrum end of the bridge with a main track and adapted to connect at its free end with a series of side tracks. The bridge track is connected with the main track by a flexible connection, so that the tracks will be continuous, and the bridge in its movement travels on segmental tracks, the bridge being swung as desired by a continuously traveling cable.

AUTOMATIC SWITCH.—William Lickstrom, New York City. For cable and other street railways this invention provides means by which a car of one line may automatically throw the switch at a junction point, and then, after passing over it, automatically throw the switch back again. A shifting lever is connected to the switch, and a spring-held link pivoted to the lever forms one end of a toggle joint acting to hold the lever in either extreme position, while levers pivoted on each side of the switch have each an arm adapted to be placed across a slot in a slotted rail and connected to the switch-operating mechanism. An arm fixed to the car enters the slot and engages the levers to throw the switch.

Mining, Etc.

AMALGAMATOR.—Francis B. Austin, Tempe, Arizona. This invention provides a simple apparatus designed to take up the finer particles or flour of gold in a sluice, the larger particles being amalgamated in a mercury pan. The sluiceway has in its bottom an opening in which is a pan of insulating material with transverse copper plates, some of them extending to the bottom of the pan and others nearly to the bottom, there being a carbon plate in the bottom of the sluiceway above the pan, and the plate being connected with the positive pole of an electric generator, whose negative pole is connected with the mercury in the pan. The plates are easily removed for cleaning them of the amalgam, etc.

Bicycles, Etc.

CONVERTIBLE BICYCLE.—Michael T. Smith, Niles, Mich. A machine which can be readily transformed from a tandem to a single seated bicycle, and vice versa, is provided by this invention, which comprises the construction of the forward tubes of both the front and rear sections in such a manner that the fork can be removed and replaced without disturbing the ball bearings of either section or removing the handles. The front section carries coupling devices adapted to be attached to the rear section, and a supplemental upright tube also adapted for connection with the rear section. Either section is designed to be sold independent of the others, and the front section is adapted to be attached to any of the single seated bicycles of similar construction now in use.

BICYCLE SPEED INDICATOR.—Barton W. Scott, San Jose, Cal. That the rider of a bicycle may see at a glance at what rate of speed he is traveling, this inventor has devised a speed indicator which consists of weights mounted to swing and driven by the motion imparted to a friction wheel held in contact with the forward wheel of the bicycle, a mechanism being set in motion by the centrifugal action of the weights to indicate the speed of the vehicle. A pointer on a dial indicates on an outer graduation the speed in minutes and seconds per mile, and on an inner graduation the number of miles per hour traveled is indicated. The device is supported by a suitable clamp from one of the arms of the front fork.

BICYCLE BRAKE.—Preston Helmon, Charleston, S. C. A quick acting brake, rendering it possible to make a very short stop, consists, according to this invention, of a curved brake shoe arranged in front of the rear wheel, there being at the top of the shoe a short metal cross bar from which cords extend through guides beneath the saddle to the handle bar. When the cords are released the brake shoe drops to the ground and the rear wheel runs upon and bears against it, or the suddenness of the stop may be regulated by holding the brake by the cords and letting it down gradually.

Miscellaneous.

EXPANSIBLE BINDING FOR BOOKS.—Charles T. Rosenthal, Batesville, Ark. This invention comprises a back made in two parts sliding one on the other, and means to secure or release the leaves by such movement. Binding strips are attached to one of the sliding back members, and a bar carrying a spring is attached to the other ends of the binding strips, a notched bar being attached to the spring at right angles, while a lever pivoted to the book cover has a notched segment engaging the notched bar. The improvement is designed more particularly for use in binding account books, so that one or more sheets may be extracted or inserted when desired, although the mechanism may be readily employed for binding periodicals.

BOOK ATTACHMENT.—Farrand C. Prindle and Clarence E. Yost, Hornellsville, N. Y. This invention relates to books with stub leaves, such as check books, etc., and provides an attachment by which the leaf may be readily blotted and torn out without the usual separate blotters and cutters. It comprises a blotter having at one end a stiff binding forming a cutter, and an elastic lateral connection between the binding and the back of the book, to permit of drawing the cutter to the inner edge of the leaf to be torn out.

PREVENTING COUNTERFEITING.—Frederic L. Dietz, Portland, Oregon. To prevent the counterfeiting of negotiable paper, checks, etc., this inventor provides a book of blanks, to be torn from stubs along perforated lines near the top and at one end, and the checks or other negotiable paper having special marks or characters corresponding to marks or characters on a tally sheet to be kept by the bank. The book and the tally sheet are also similarly numbered, so that the teller of a bank may readily refer to the tally sheet on presentation of a check. The book is so bound that a check and its stub cannot be fraudulently removed.

PICKING CURLED HAIR.—Edgar Beers, Brooklyn, N. Y. This patent is for a machine to pick the curled hair from the rope and finish it, discharging the finished product as sheets adapted for use by the upholsterer. The rope passes between feed rollers, playing past the bite of which is a reciprocating comb bar carrying teeth inclined to the direction of movement of the bar, the teeth, as they move in one direction, drawing out and loosening the hair, while they clear themselves from the rope when the bar moves in the other direction. It is desirable usually to pass the product twice through the machine, and two machines are preferably arranged to work together, one to work directly on the ropes and the other on the product of the first machine.

DUMPING WAGON.—Thomas Hill, Jersey City, N. J. According to this improvement hollow pedestals are attached to the rear ends of the frame sills and also to the axle of the wagon, each pedestal being inclined downward and rearward on its upper side, and each having in such inclined portion a guide slot into which extends a shaft mounted to rotate on the wagon body, the shaft rotating in bearing blocks on the body. After the front end of the body has been raised the body moves downward, with the roller shaft rotating on the inclined portion of the pedestals. The wagon has few parts and is not liable easily to get out of order.

BEER COOLING DEVICE.—Conrad Heller, Brooklyn, N. Y. According to this invention, a cooling chamber is placed between the beer barrel and the faucet, the chamber containing a vessel connected at top and bottom to the faucet and the barrel, while the pipes connecting the vessel with the faucet and the barrel are coiled about the cooling vessel before being led away. The cooling vessel and its surrounding coils are placed in the bottom of a small ice box and kept surrounded with ice. The device is intended to insure that all beer drawn at the bar shall be cool, no matter how fast it is drawn, and to do this more economically than by cooling the whole barrel from the outside.

FILTERING APPARATUS.—Pierre Droeshout, Paris, France. For filtering liquids, such as cane juice, etc., this invention provides a longitudinally movable filtering bed, and devices for drawing the liquid through the bed. A heating box is arranged at one end of a frame supporting a series of receivers connected with suction pumps, auxiliary suction devices being connected with the receivers, while a filtering bed in the form of an endless band passes over the heating box and the receivers, the band passing over a fluted roller. The endless band filtering bed passes over a washing tub arranged in the frame, a pipe discharging washing liquid onto the bed, and a suction pump being connected with the washing tub.

DOOR SECURER.—Peter Dunwald, Rio, N. Y. This device consists of a V-shaped spring plate, having on one of its members at its outer end saw teeth or serrations projecting rearwardly toward the apex of the plate, while centrally of the leaves of the plate, near the apex, are registering apertures adapted to receive a key. The key engages the inside of the door and part of the casing, when the device is placed between the door and its casing, in closing the door from the inside, and the teeth engage the casing to prevent the door being opened from the outside. The device is very simple and may be conveniently carried by a traveler for use in stopping at hotels, etc.

NON-REFILLABLE BOTTLE.—Harry L. Beekman Lee, Albany, N. Y. This invention provides a bottle and stopper which makes the bottle useless after once being emptied, and which is proof against refilling by immersion, pumping or other means. The bottle neck has on its inside inner and outer flanges between which is held a stopper or plug carrying valves and safety devices, and this plug fits snugly in the throat of the neck of the bottle, and when once seated therein is permanently retained, so that it cannot be removed except by breaking the bottle. The valve allows the contents of the bottle to flow out when the bottle is inverted, and closes automatically when the bottle is on its base.

DISH MOP.—George W. Taylor, Marblehead, Mass. To facilitate dish washing, this inventor provides a short-handled mop having an inner bunch of threads grouped around the handle, and a fringe having a band of dependent threads, the band encircling and binding the bunch of threads in place on the handle, and the fringe threads extending alongside the bunch threads and being bound thereto.

SYRINGE.—Lemuel Hines, Springer, New Mexico. This is a syringe especially designed for injecting medicines into hard and resisting tissues, as the gums, etc., and wherever there is much obstruction to the flow from the needle. Instead of using pressure with the thumb, as in the ordinary syringe, the piston is operated by a screw and is forced forward by turning as a thumb screw, each turn being designed to eject about a minim. By means of a detachable nut on the head of the barrel, the syringe may be charged as quickly as the ordinary hypodermic syringe, and it may, if desired, be used in the same way, with thumb pressure. The plunger and packing do not rotate with the piston, but only receive the push and pull motion.

SYRINGE.—Hermann W. Luer, Paris, France. As a new article of manufacture, this inventor has devised a syringe having no detachable parts, as glands, stuffing boxes, etc., and which may readily be kept perfectly clean and antiseptic. It comprises a glass cylinder or barrel, with reduced outlet end and an annular flange at the other end, while operating in the cylinder is a glass plunger whose body portion is practically as long as the cylinder, the interior of the cylinder and the exterior of the plunger throughout their length being ground, and making a practically air and liquid tight connection betwen the plunger and barrel.

SPRING GUN.—Charles Harold, New York City. This is a toy gun or pistol having a stop extending within the barrel and operated by the trigger. The barrel has a slot in each side, and an ejecting device consisting of springs at each side, having their ends connected, one connection being made with the muzzle end of the barrel and the other with the end of the ejecting device arranged to travel in the slots of the barrel, and for engagement with the trigger.

Designs.

TILE.—Arthur H. Bonnell, Brooklyn, N. Y. This is a tile with edges alternately concaved and convexed, the radii being approximately alike and the segments of the convex portions having a common center. There are three convex and three concave edge portions on each tile.

SPOON.—Celestin G. Tingry, Portland, Oregon. The handle portion of this spoon at its outer end represents an elk's tusk or tooth, and adjacent thereto is a clock dial, the hands pointing to "11," while in the bowl is shown an elk in the act of drinking.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co. for 10 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS, ETC.

THE DARJEELING HIMALAYAN RAILWAY. Illustrated guide for tourists. First edition. London: McCorquodale & Company, Limited. 1896. Pp. 46.

This pamphlet gives some interesting illustrations of the trains on the Darjeeling Himalayan Railway, showing the bridges, the path through the trackless forest, the interesting slopes and the vegetation which is to be found in thisstrange part of the world. The pamphlet is very handsomely got up.

STEPHENSON'S ILLUSTRATED PRACTICAL TEST, EXAMINATION AND READY REFERENCE BOOK. For stationary, locomotive and marine engineers, firemen, electricians and machinists to procure steam engineer's license, also working chart for setting out the forms of gear teeth so that any two wheels of a set may work together. Chicago: Laird & Lee. 1896. Pp. 128. Price $1.

This is a manual intended to enable engineers to obtain licenses. Like many other works on the same subject, it is arranged in the form of questions and answers. The diagrams of dissected pumps are excellent.

WIRING TABLES AND HOW TO USE THEM. By Thomas G. Grier. Chicago. Pp. 75. Price $1.

This is a book designed to facilitate the work of electricians, the calculations made in the tables covering the demands usually arising in practical wiring when it is necessary to determine the sizes of wires for the distribution of electricity. The book has a chapter on electromotive force and current and one on methods of wiring, besides its numerous tables.

CARPENTRY AND BUILDING. Series No. 1. Cottage designs, with constructive details by various architects. A practical book for builders and those intending to build. A series of twenty-five designs of cottages, most of which have already been erected, ranging in cost from $600 to $1,500, together with the details of interior and exterior finish, all drawn to convenient scale, and accompanied by brief specifications. New York: David Williams. Price $1.

SULLA PROPAGAZIONE DELL 'ELETTRICITA NEI GAS ATTRAVERSATI DAI RAGGI DI RONTGEN. Memoria del Professor Augusto Righi. Bologna: Tipografia Gamberini E. Parmeggiani. 1896. Pp. 73.

This book, which is a treatise on Roentgen ray phenomena, is to be accepted as a welcome contribution from Italy, a country now very active in scientific matters, especially in those touching on electricity.

METALLURGY OF CAST IRON. A complete exposition of the processes involved in its treatment, chemically and physically, from the blast furnace through the foundry to the testing machine. Cleveland, Ohio: By Thomas D. West. Fully illustrated, first edition. 1897. Pp. x, 573. Price $3.

This capital work at last gives American practice in blast furnaces and cupola work. Our space is entirely inadequate to review it. We can simply state that it seems fully practical, very exhaustive and is very fully illustrated. An interesting chapter is given at the end called "A Hundred Items to be Remembered." These items are given in so trenchant a form as to form a capital feature of the work, covering, as the author states, broad experience, extensive research and careful conclusions. A very systematically and excellently arranged index is not the least feature of its merits.

THE OPTICAL DIRECTORY FOR THE YEAR 1897. Being a list of all manufacturers and dealers in optical goods in the United States. Frederick Boger, Maiden Lane, New York City. Pp. 95. Price $1.

ELEKTRICITAT DIREKT AUS KOHLE. Von Etienne de Fodor. Wien, Pest, Leipzig: A. Hartleben's Verlag. 1897. Pp. x, 304. Price $1.20.

Electricity direct from coal would seem hardly a sufficient subject for a treatise of this length, but it is evident that a considerable amount of work has been done on this subject, which now may rank almost as the ignis fatuus of the electrical inventor. It really seems surprising that enough has been done to lead to so exhaustive and well thought out a treatise as the following one, the list of names alone occupying an index form of two pages. We think a perusal of the book would be useful to all prospective inventors.

LABORATORY PRACTICE FOR BEGINNERS IN BOTANY. By William A. Setchell. New York: The Macmillan Company. London: Macmillan & Company, Limited. 1897. Pp. xiv, 199. Price 90 cents.

This excellent text book attempts a somewhat difficult task—the production of a systematic laboratory course in botany. It is precisely by reduction of study to system that a pupil is often rescued from a slough of despond and made to feel inspiration, with the skeletons given him on which to build up what he has acquired. Its 199 pages of laboratory practice are varied by a very full series of appendices, which latter really form an integral portion of the work. A very exhaustive index, some 15 pages in length, is an excellent example of what the index to a scientific book should be and adds very largely to the value of the work.

BEARINGS AND LUBRICATION. A handbook for every user of machinery. By A. J. Wallis Tayler, C.E. New York: D. Van Nostrand Company. Pp. viii, 208. Price $1.50.

This work is very complete. It treats on a most important subject, one which has received in the past very little attention from engineers. If an engineer has plenty of steam, he is apt not to care how badly packed is his stuffing box; and as long as his bearings do not hammer, the friction too often is something which he never thinks about. Such books as the one in review are of special importance as calling the engineer's attention to the logical treatment of wasted energy with a view to its reduction to a minimum. The work has an adequate index and is finely illustrated.

ANNALS OF THE ASTRONOMICAL OBSERVATORY OF HARVARD COLLEGE. Vol. XXXVI, Journal of the zone observations of stars observed with the meridian circle during the years 1875 to 1885, under the direction of Joseph Winlock and Edward C. Pickering, successive directors of the observatory. By William A. Rogers. Printed from funds resulting from the will of Josiah Quincy, Jr. Waterville, Me.: Printed at the office of the Waterville Mail. 1896. Pp. 299.

ANNALS OF THE ASTRONOMICAL OBSERVATORY OF HARVARD COLLEGE. Vol. XXVIII, Part I. Spectra of bright stars photographed with the 11 inch Draper telescope, as a part of the Henry Draper memorial, and discussed by Antonia C. Maury, under the direction of Edward C. Pickering, director of the observatory. Cambridge: John Wilson & Son, University Press. 1897. Pp. 128.

GUIDE DE POCHE. Franco-American Illustré des Etats Unis. 1897. Pp. 267. Price 50 cents.

This guide book to America would seem adapted to be of considerable use to the French visiting America. The attempt to cover the United States in so small a book, however, seems to be a somewhat daring one. It is largely made up of addresses of French-speaking persons or firms in different cities, and may be, in spite of its somewhat limited size, quite comprehensive.

POPULAR SCIENTIFIC LECTURES. By Ernst Mach. Translated by Thomas J. McCormack. With forty-five cuts and diagrams. Chicago: The Open Court Publishing Company. 1896. Pp. 313. Price 35 cents.

In these lectures quite a number of subjects are considered, largely in physics, mechanics and physiology. The lecture on the "Conservation of Energy," although a subject which seems rather a trite one at the present day, is really quite interesting from the number of historical data embodied, and because of its tracing the development of the doctrine from the earliest days of modern physics.

THE EVOLUTION OF AUTOMATIC MACHINERY. As Applied to the Manufacture of Watches at Waltham, Mass., by the American Waltham Watch Company. By E. A. March. With half tone illustrations. Chicago: George K. Hazlitt & Company. 1896. Pp. 150. Price $2.

The American watch is the production of automatic machinery, and the title page of this book indicates its contents sufficiently to make it evident how interesting it would be to those interested in the latest developments in the manufacturer's art as applied to the watch. The finest products of the automatic system of watch making

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are treated in this work, and its origin goes to emphasize its authoritative standing.

CADET LIFE AT WEST POINT. By Lieut. Hugh T. Reed, U. S. A. Illustrated. Chicago: Published by the author. Pp. 236, xx. Price $1.50.

This very spirited and interesting book tells how the United States cadets live at the military academy. The author seems to have been very fond of his alma mater, and writes about the humorous and social features of it with considerable gusto. Numerous illustrations are given, and among them examples of the different forms, social and official, are given, such as programmes of performances, appointment blanks and the like. We predict for the work a very interested circle of readers.

THE PRACTICAL MANAGEMENT OF ENGINES AND BOILERS. Including boiler setting, pumps, injectors, feed water heaters, steam engine economy, condensers, indicators, slide valves, safety valves, governors, steam gages, incrustation and corrosion, etc. A practical guide for engineers and firemen and steam users generally. By William Barnet Le Van. Philadelphia: Philadelphia Book Company. Practical, scientific and technical books. 1897. Pp. xvi, 267. Price $2.

THE GUN AND ITS DEVELOPMENT. W. W. Greener. Sixth edition. New York: Charles Scribner's Sons. 1897. Pp. xvi, 768. Price $4.

This treatise on the gun, by Greener, up to its last developments, in over 700 pages, can only be designated as of the greatest importance. No sportsman, really loving his gun, can afford to dispense with this work, as it covers every conceivable branch of this subject. Some very interesting examples of early guns and combined weapons and pistols are given, with illustrations of beautiful products of olden times, in the way of flint lock muskets and the like. These topics are so treated as to form a most interesting portion of the work. Exceedingly interesting data are given. We cannot refrain from citing some. It seems, as late as the year 1636, at the battle of the Kuisyingen, the slowest soldiers managed to fire seven shots only during eight hours; and a year later, in an action lasting from noon until eight in the evening, the musketeers fired seven times only. The historical portion has numerous illustrations, which would entitle the work to a place in any library, and makes it a wonderful contribution to man's ingenuity as developed in the way of destroying the lives of his fellow creatures. The work is imported by Scribner's Sons, and constitutes the sixth edition of the original work, rewritten.

THE ELEMENTS OF PHYSICS. A College Text Book. By E. L. Nichols and William S. Franklin. In three volumes. Vol. III. Light and Sound. New York: The Macmillan Company. London: Macmillan & Company, Limited. 1897. Pp. vii, 201. Price $1.50.

We here at last have a third portion of this classical treatise. It is in the line of its predecessors, carrying out the same principles. There is little to be said about it in review, except that it has the aspect of thorough modernness and puts the subject at last upon its present modern basis.

TABLES FOR EARTHWORK COMPUTATION. By C. F. Allen. Boston: Published by the author. 1893. Pp. 38. Price $1.50.

The book is devoted simply to calculations for earthwork, and will naturally be found of great use by surveyors, engineers, and others who have to calculate masses of material which are often very awkwardly shaped. It marks the tendency of the day to produce special scientific monographs, each of which will be essential to a definite clientele of scientific workers.

THE DESIGNING AND CONSTRUCTION OF STORAGE RESERVOIRS. By Arthur Jacob. New York: Van Nostrand Company. 1897. Pp. 138. Price 50c.

This is a valuable addition to the green covered Van Nostrand series, many numbers of which have come to our notice. The city of New York has had ample experience in storage reservoirs, whereby the cumulative effect of a large watershed is developed and the spring freshets are in a greater or less measure made available for summer supply. The subject is an important one, and tends to become more so.

The Shoe and Leather Reporter Annual for 1897 has a valuable compilation of interesting facts and figures relative to the shoe and leather trades, of which also it affords a complete business directory for the United States and Canada, and lists of the leading houses throughout the world. It is one of the best of the annual volumes thus far published by the Reporter, and great care has been taken to make it as nearly accurate as such works can ever be. It appears from it that the shipments of boots and shoes from Boston in 1896 were 3,940,170 cases, or, allowing thirty pairs to the case, 118,205,100 pairs. These figures are just about double those of 1879, and indicate how far New England is ahead of the rest of the country in the shoe business. The exports of American leather and its manufactures also show a large and steady increase, amounting last year to $20,242,756. And as our exports of leather have increased, our imports, which used to be very large in fine calfskins and kids, have steadily diminished, owing to the great improvement made in the productions of American leather manufacturers.

The Locomotive, in its bound volume for 1896, of 190 pages, forms a valuable record of facts especially interesting to all steam users. Published by the Hartford Steam Boiler Inspection and Insurance Company. It always has most reliable data as to the causes of accidents and the best means for their prevention. Its contents are prepared with great care, J. M. Allen, the president of the company, being the editor.

Business and Personal.

The charge for insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in the following week's issue.

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Anderson's Typewriter makes longhand faster than shorthand—one stroke prints a word! 97 Nassau St., N. Y. (See illustrated notice SCI. AM. May 22, p. 325.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4. Munn & Co., publishers, 361 Broadway, N. Y.

The Temperly Transporter.

See illustration, front page of SCIENTIFIC AMERICAN, April 24. It is manufactured by the Lidgerwood Mfg. Co., 96 Liberty Street, New York. Write for particulars.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(7165) R. J. L. asks how to repair books in an economical manner. The first thing is to secure the loose leaves. Odd leaves can be fixed in with paste or thin glue. If a whole section is loose, first sew it with stout thread, leaving long ends at the back, and then tie these ends to the part that goes before and the part that follows. A sheet of paper glued on the back will fix it in its place, letting a little glue go in before and after the sewed section. If the book has slipped out of the cover, leaving the cover intact, the best way is to strip all the paper off the back (not sides) of the cover, leaving the cloth (or leather, as the case may be) bare; then glue the back of the quires, and stick them on the cloth. This, with or without new end papers, will complete the job. This makes what is called a tight back; but it will open fairly well if all the padding is taken out, as directed above, and will make a strong binding. If only one cover is torn off, it can be fastened on thus: Raise the leather of the cover from the millboard with a penknife to the depth of one-half inch (or less if book is small). Get a piece of cloth, about one inch wide, and glue this into the opening made; do the same with the back of the book, and put in the remaining one-half inch of cloth with glue, and the job is done. They are not handsome, but are always strong.

TO INVENTORS.

An experience of nearly fifty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

JUNE 1, 1897,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

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Advertising device, E. Fletcher 583,679
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(Continued on page 382)

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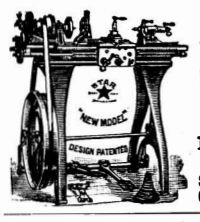

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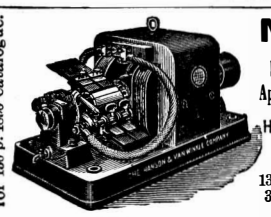

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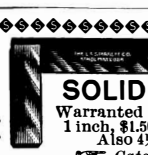

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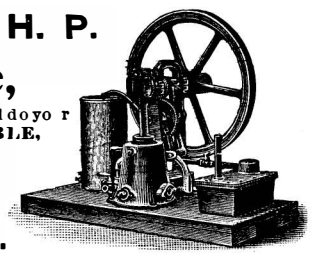

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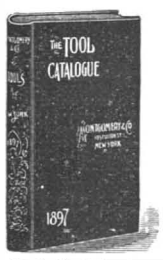

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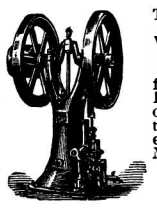

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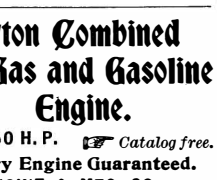

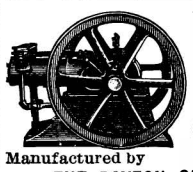

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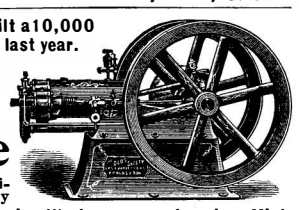

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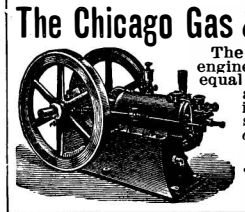

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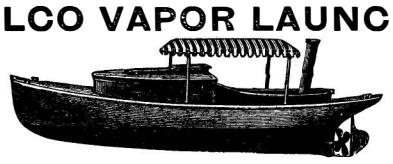

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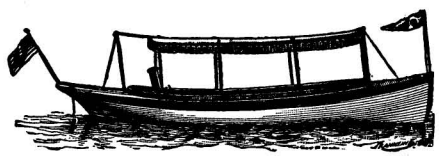

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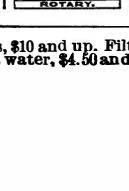

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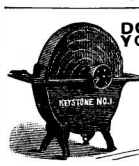

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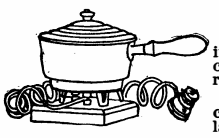

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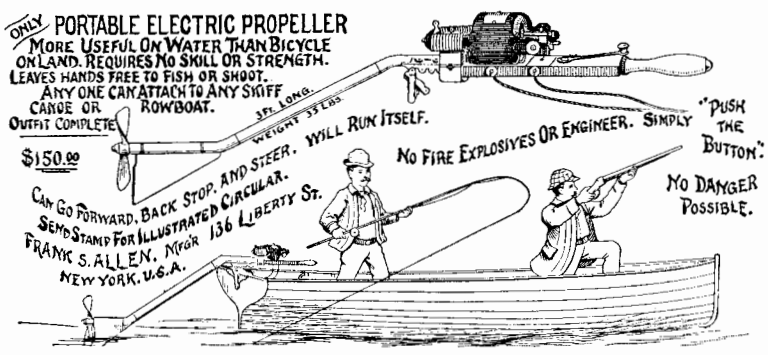

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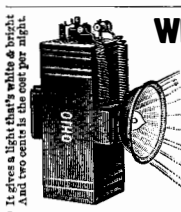

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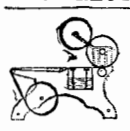

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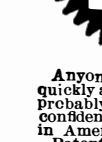

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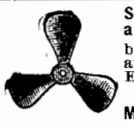

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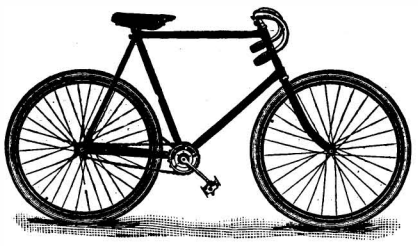

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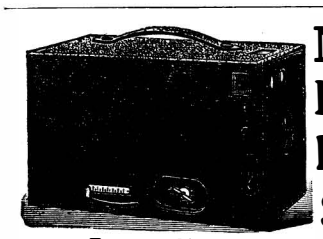

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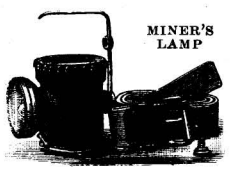

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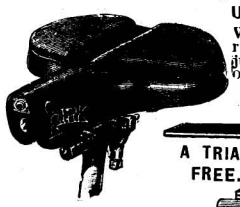

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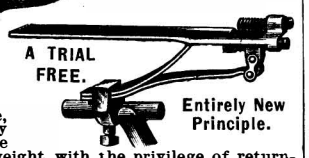

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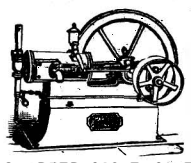

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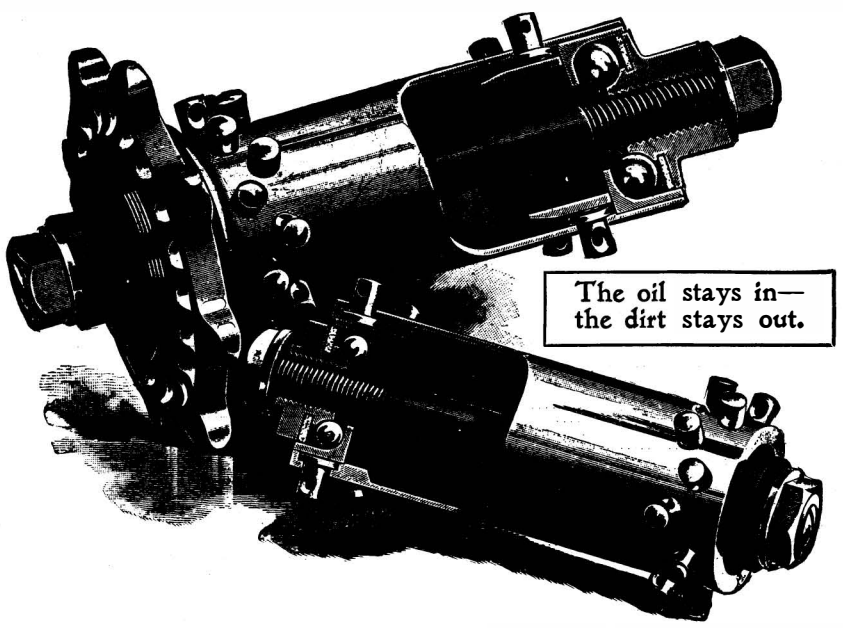

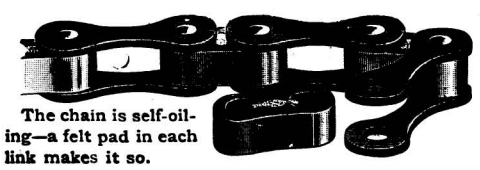

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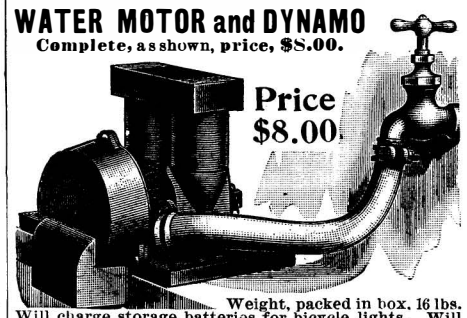

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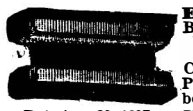

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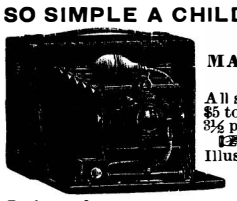

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